Radio, Electronics and Communications

FORMERLY "RADIO & ELECTRICAL REVIEW" — WIDELY KNOWN SINCE 1946 AS "R. & E."

MPL

In This Issue . . .

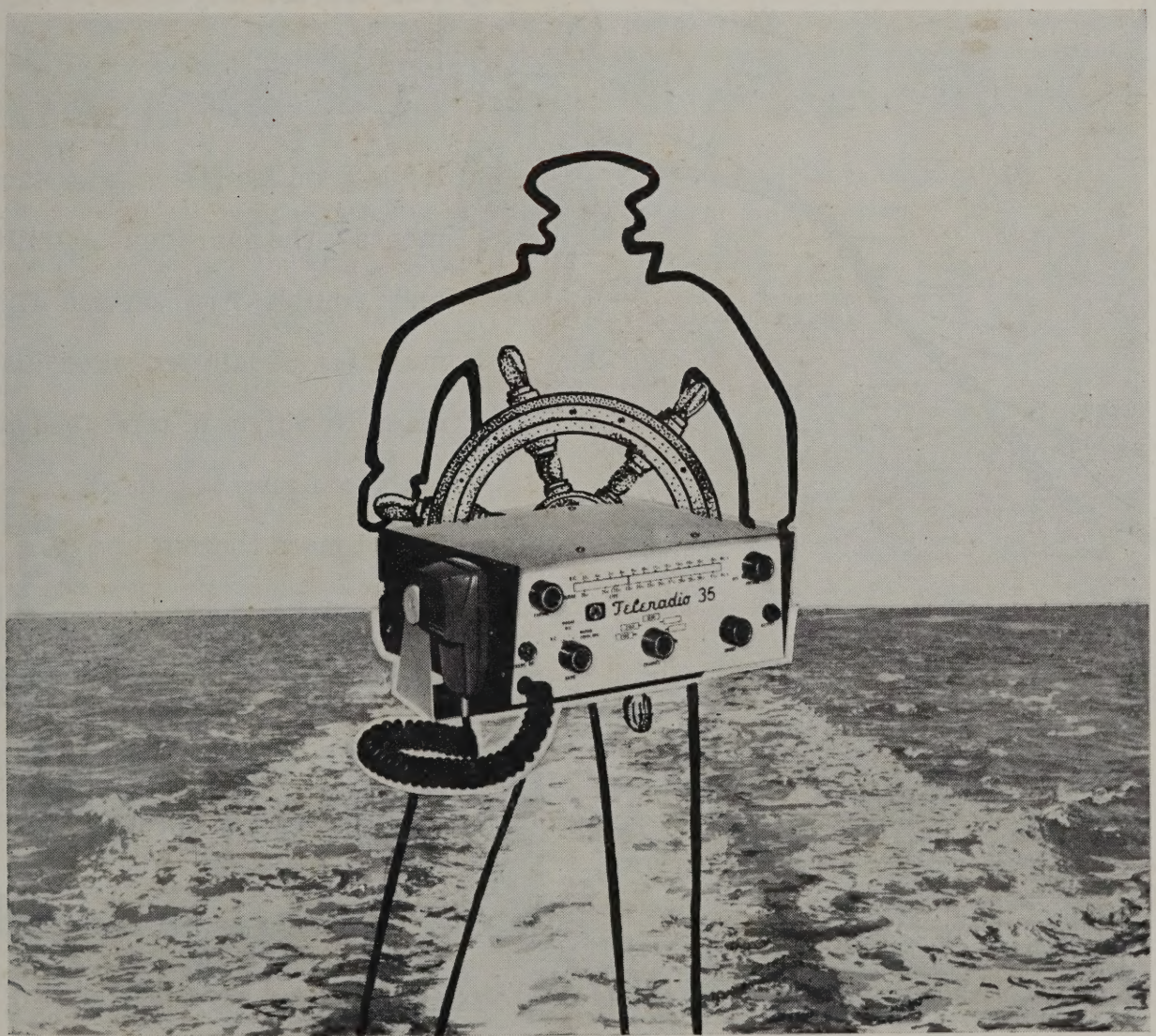
- Medium Power Semiconductor Rectifiers
- Looking At Magnetic Core Memories
- R.E. & C. 6" Experimenters TV. Receiver
- How to Repair Communications Receivers
- Abstracts from the N.Z. Science Congress
- Listening Post

PUBLISHED MONTHLY IN THE INTERESTS OF THE N.Z. ELECTRONICS INDUSTRY FOR ALL LEVELS, FROM PROFESSIONAL TO AMATEUR.

VOLUME 19 NUMBER 12

FEBRUARY 1, 1965

PRICE 2/6

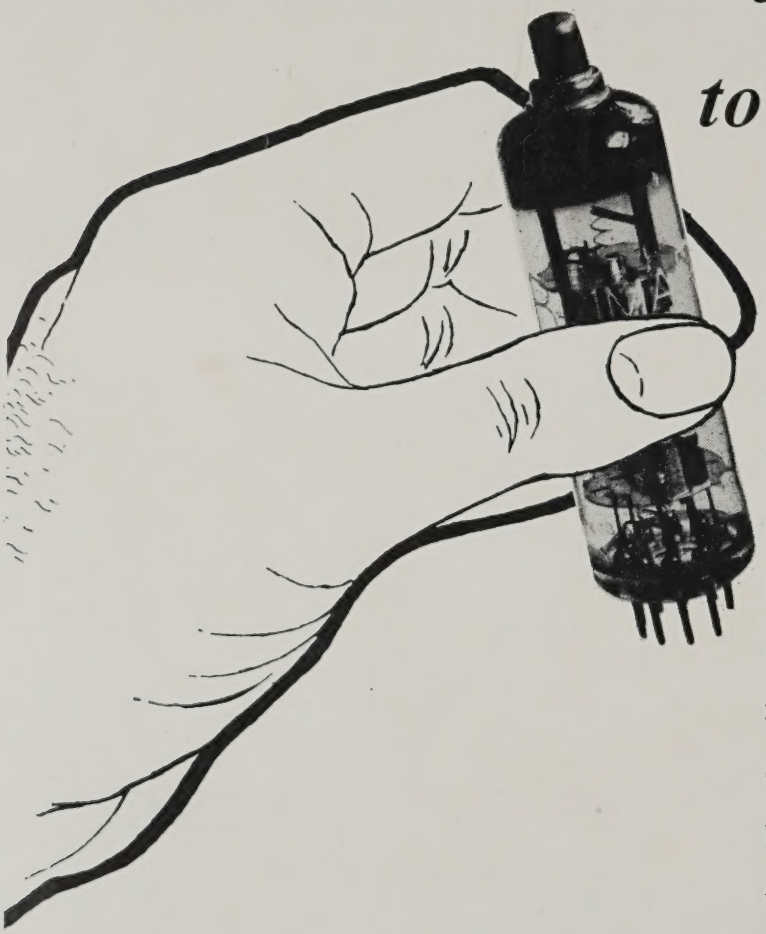


AWA announces Teleradio 35 for small ships

ENQUIRY CARD AD. 1

whenever there's "just a valve"

to be replaced . . .



. . . there's one simple way for the service engineer to safeguard his good name. Replace with a Brimar valve. The same holds good for teletube replacements — the same dependability and trouble-free service that make for a really satisfied customer. No valves or teletubes are built to higher standards or are tested more thoroughly.

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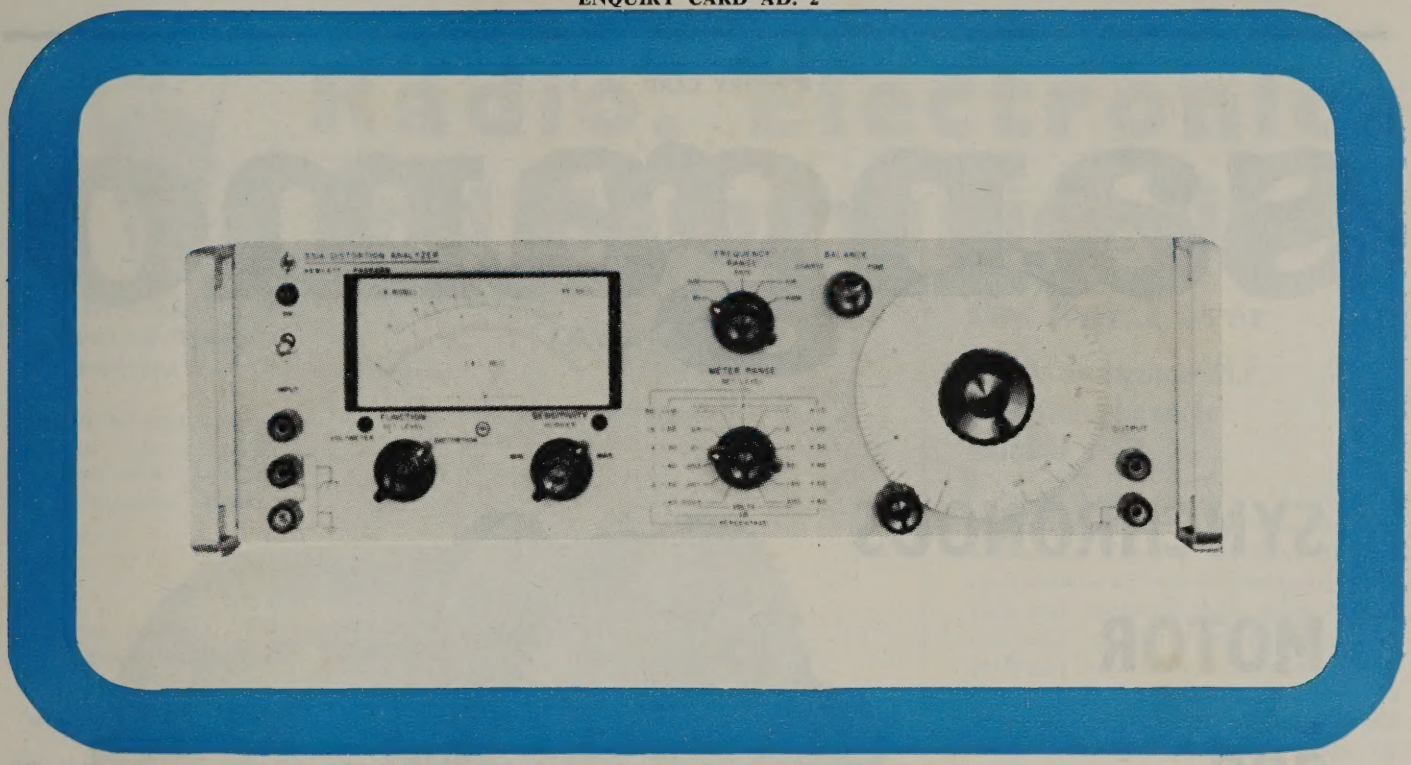
ENQUIRY CARD AD. 2



NEW, IMPROVED Frequency Range (5 cps to 600 kc fundamental) Sensitivity (0.3 v rms for 100% set level) Selectivity

in the hp 331A Harmonic Distortion Analyzer — solid-state version of the historic standards of the industry, the Hewlett-Packard 330 Series!

The industry-leading 330's have gone solid-state in the new Hewlett-Packard 331A, which offers extended tuning range, greater set level sensitivity, improved selectivity, greater over-all accuracy and easier use — AND PRICED AT ONLY $590! (Current N.Z. price available on application).

Solid-state design allows battery operation for floating measurements, and total improvements add up to previously unavailable measuring capabilities in determining total audio distortion; voltage level, power output and gain; total distortion of AM rf carrier; noise and hum level and audio signal frequency.

The specifications tell the total story. Check them over carefully. Compare them with performance of any other distortion analyzer.

Distortion measurement range: Any fundamental frequency, 5 cps to 600 kc; distortion levels of 0.1% to 100% measured full scale in 7 ranges

Distortion measurement accuracy:

Harmonic Frequency		Input	
0.3% to 100% F.S.	0.1% F.S.	Below 30 v	Above 30 v
10 cps—1 mc	20 cps—500 kc	±3%	±3%
1 mc—3 mc	500 kc—1 mc	±6%	±12% (1 db)
	10 cps—20 cps	±12% (1 db)	±12% (1 db)
Elimination characteristics: Fundamental rejection >80 db			
Second harmonic accuracy: Better than +1 db from 5 to 20 cps; ±0.6 db from 20 cps to 20 kc; —1 db from 20 to 100 kc; —2 db from 100 to 300 kc; —3 db from 300 to 600 kc			

Frequency calibration accuracy: Better than ±2% from 10 cps to 200 kc; —3% from 5 to 10 cps; +8% from 200 to 600 kc

Input impedance: Distortion mode: 1 megohm shunted by <60 pf or use hp 10001A divider probe
Voltmeter mode: 1 megohm shunted by 30 pf, 1 to 300 v rms; 1 megohm shunted by 60 pf, 300 μv to 0.3 v rms

Input level for distortion measurements: 0.3 v rms for 100% set level (up to 300 v for set level indication may be obtained with front panel attenuator)

DC isolation: Signal ground may be ±400 v dc from external chassis

Voltmeter range: 300 μv to 300 v rms full scale (13 ranges) 10 db per range; 5 cps to 3 mc (300 μv range: 10 cps—1 mc)

Voltmeter accuracy:

Range	±2%	±5%	±12%
300 μv	30 cps—300 kc	20 cps—500 kc	10 cps—1 mc
1 mv—30 v	10 cps—1 mc	5 cps—3 mc	
100 v—300 v	10 cps—300 kc	5 cps—500 kc	5 cps—2 mc

Noise measurements: Voltmeter residual noise on the 300 μv range: <25 μv rms terminated in 600 ohms; <30 μv rms terminated with a shielded 100 k resistor

Price: $590

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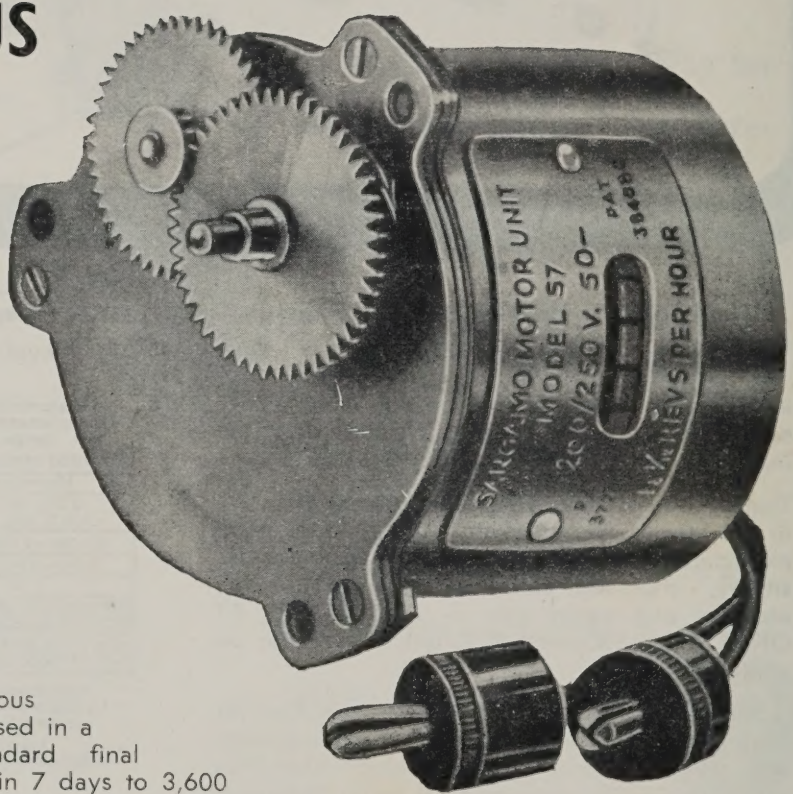
ENQUIRY CARD AD. 3

sangamo

SYNCHRONOUS MOTOR and CLOCK UNITS



The SANGAMO S7 motor unit consists of a self-starting synchronous motor driving a train of gears housed in a sealed dust-proof housing. Standard final spindle speeds range from 1 rev. in 7 days to 3,600 revs. per hour. The ideal unit for frequency controlled timing mechanisms such as electric clocks, time switches, chart drives, and any light mechanism requiring a definite time interval.

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On Our Cover

AWA annouuce H.F. Radiotelephone for smaller craft

Amalgamated Wireless (Australasia) N.Z. Limited, who manufacture the well-known Teleradio 64 Mark II, and the Teleradio 65, which is being exported, have now extended their range by introducing an HF Radiotelephone of particular interest to owners of smaller boats. It is the Teleradio 35, which is self-contained, and miniaturised, and designed for easy installation in the 14' and 18' class of small boats which have previously been handicapped by the availability of only bulky and inefficient communication equipment.

The receiver and power supply of the Teleradio 35 has been transistorised to reduce battery drain, and increase reliability. A base loaded 12' fibreglass whip aerial and a specially designed antenna coupler, which does away with the need for a ground plate, are also available for use with this radiotelephone.

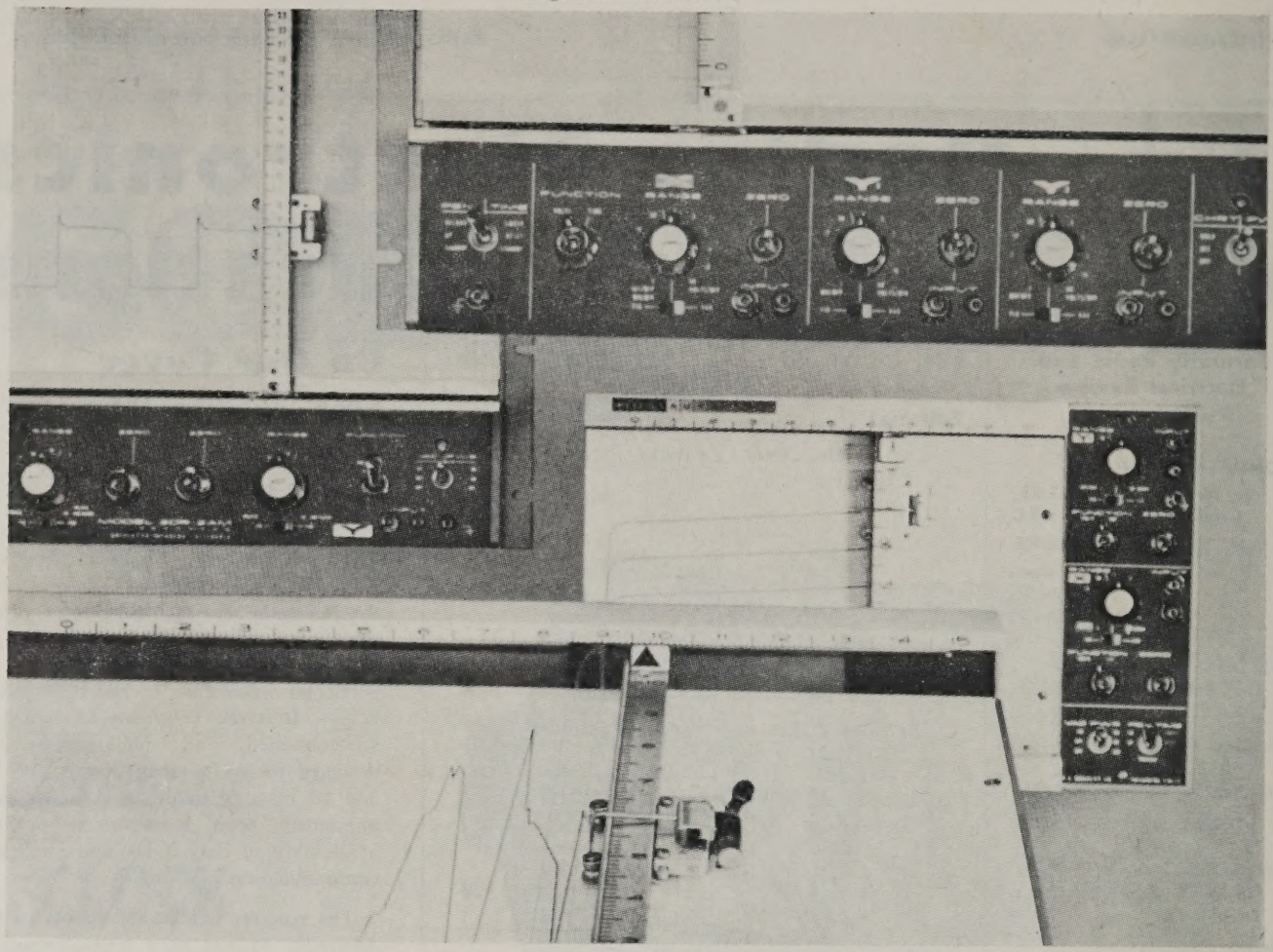
The AWA Teleradio 35 is designed to be installed by the boat owner, and is preset on three transmitting frequencies at the factory. Additional frequencies can be fitted as required. The transmitter input power is 35 watts, and the receiver covers broadcast and marine frequencies from 2-3Mc/s, in two bands.

COMING . . .

Stereo Balancing Indicators
Thin Film Glass Memories
"A Transistor to out Transistors"
A Transistorised Thermometer
Atomic Frequency Standard

Also . .

Book Reviews
New Products
Listening Post
Serviceman's Column
Circuit & Service Data



You can do your best plotting with Moseley servo-recorders. Moseley offers 52 models of x-y recorders as well as a line of flexible strip-chart recorders and today's most complete line of accessories. Check the

for the RECORD

X - Y RECORDERS

brief specs here, then call your hp field engineer for a demonstration of the model most useful to you.

Prices listed are those current in America.

Model	Characteristics	Price
7050A	8½" x 11" x-y basic systems recorder, single range, all solid state	$975
135C	8½" x 11" recorder, dc input, 10 fixed ranges each channel and continuously variable	$1190
135	8½" x 11", compact portable, desk or rack mount 16 ranges and time sweep	$1650
135A	Similar to 135, but has one megohm input impedance on 11 ranges	$1650
7030A	8½" x 11" x-y recorder, 100 microvolts/in. sensitivity, portable or rack mount; AUTOGRIP*; 1 megohm input impedance on all ranges, floating and guarded, high common mode rejection	$1795
136A	Two-pen x-y$_1$,-y$_2$ version of 135A	$2650
6SA	10" x 10" rack mount recorder with automatic chart advance, up to 120 charts on single roll; one megohm input on 16 ranges each axis	$3150
7	32" x 32" x-y recorder, ideal for p'otting table; vertical or horizontal mounting	$3950

Model	Characteristics	Price
2D-4 (bench) 2DR-4 (rack)	11" x 17" recorder, dc input, 10 fixed ranges and continuously variable	$1490
2D-2 (bench) 2DR-2 (rack)	11" x 17" recorder, accepts dc inputs 16 ranges on each axis; built-in time sweep, all solid state	$1950
2D-2A (bench) 2DR-2A (rack)	Similar to 2D-2, except provides one megohm input resistance on 11 ranges	$1950
2D-3 (bench) 2DR-3 (rack)	Similar to 2D-2, omits built-in time base; ideal for computer use; accepts ± 100 v computer reference	$2050
7590A	11" x 17" x-y nuclear plotting system, null detector, character printer	$1985
7000A	11" x 17" recorder, ac or dc inputs on each axis, resettable time sweep; AUTOGRIP*; 1 megohm input impedance on all ranges, floating and guarded, high common mode rejection	$2575
2FRA	11" x 17" two-pen x-y$_1$,-y$_2$ recorder, built-in time base	$3575

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Letter to the Editor

Sir,

re your 5" TV. set in the latest issue. VCR97s are impossible to get. Most experimenters can only afford a 3" tube and would get more consistent results from a new tube if they used one. If the oscilloscope doubled as a TV. set it would be worthwhile building one. The receiver could be built on the unit principle and should use a standard power transformer.

It is the timebases and sync. circuits for an electrostatic tube that have been missing. Brightness modulation could be so handy on an oscilloscope. The line time base would provide EHT as in a real TV. and the good sync. circuits necessary would help experimenting. Such a unit would be marvellous for testing audio gear and using it for TV. would keep it constantly fit. For workshop gear is usuallly in such poor shape when testing begins no one is certain which to blame, the experiment or the test gear.

Yours faithfully,

"TRANSISTOR".

Your letter was read with interest. The thought crossed my mind that it may have been written with tongue in cheek. However taking it at face value and that your comments are genuinely considered we will consider each part separately.

(1) VCR97 availability. Many of these are still in use and many more are residing in packets on shelves. I also have before me another local journal dated December 1964 in which a firm is advertising VCR97's. (2) At the prices I can find a new 3 inch tube is from 3 to 5 times the price quoted for VCR97's. (3) We have only utilised standard power transformers in the design published. (4) The time bases and sync. circuits were published in Jan. issue. As mentioned elsewhere we were unable to include them in the December issue. (5) Brightness modulation is not often utilised in an oscilloscope because the grid already is normally employed as part of the sweep retrace blanking circuitry. However many oscilloscopes do provide the Z axis or grid connection if required. (6) The line timebase could provide EHT for the scope PROVIDING THAT you were prepared to wind a special transformer to suit the much lower EHT requirements. I would be interested to know however how you could also make this compatable with electrostatic deflected tubes which are most commonly found in the 3" or 5" screen series. (7) Your comments on workshop test gear are unfortunately only a little too true in some cases but this state of affairs should be soundly discomaged.

—Ed.

ENQUIRY CARD AD. 22

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INTERFERENCE

and NOISE

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OF APPLIANCES AND EQUIPMENT

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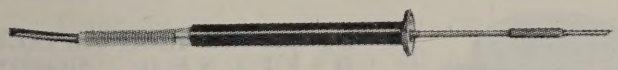

10 WATT. Extra lightweight for miniature components, transistors, instruments, printed circuit boards. Heating time to working temperature 90 seconds. Shaft diameter ⅛"; Head diameter 3/16".

Type	Voltage	Colour	
4/10	4V	RED	For use with National and A&R Transformers rated at 3.3 volts.
6/10	6V	BLACK	For use with approved transformers with tapped secondaries for heat control.
12/10	12V	GOLD	For Model Railway Hobbyists. Operates off train voltage supply.

20 WATT. General purpose for regular electronic wiring and servicing. Most popular model, pleasant to handle. Performance equal to heavy, high wattage mains operated irons. Heating time to operating temperature 2 minutes. Shaft diameter 3/16"; Head diameter ⅜".

Type	Voltage	Colour	
4/20	4V	RED	Supply same as 4/10.
6/20	6V	BLACK	For use with approved transformers with tapped secondaries.
12/20	12V	GOLD	For use with approved 12V transformers.

40 WATT. Heavy duty model for continuous bench use. Head operates at 600°F. Suitable for light metal, heavy terminals, auto connectors, heavy duty radio or appliance assembly. Shaft diameter 3/16". Head diameter ½".

Type	Voltage	Colour	
12/40	12V	BLACK	For use with approved transformer or battery.

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ENQUIRY CARD AD. 7

NEW LUCAS PRODUCTS RATINGS PRICES

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DD 40 SERIES DIFFUSED SILICON RECTIFIERS

* Extended Voltage Range up to 1350V. transient P.R.V. * International standard outline to VASCA SO–10 Jedec DO4. * 6 Amperes at 100°C stud temperature. * Immediately available at realistic prices. * Reverse polarity types available.

ZD 4000 SERIES DIFFUSED SILICON VOLTAGE REGULATORS

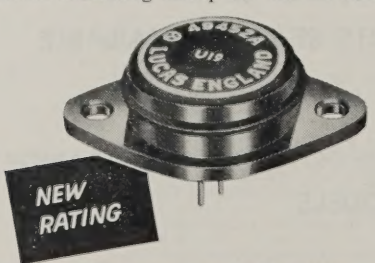
* 10 Watts total dissipation at 100°C stud temperature. * Available from 12 to 100 Volts. * Available with nominal tolerance on voltage of 5% or 10%. * Reverse polarity types available. * Commercial equivalents of CV7205 to CV7227 and CV7247 to CV7269. * Replacements for ZD500 series voltage regulators.

DD 4520 SERIES DIFFUSED SILICON RECTIFIERS

* 10 Amps at 150°C stud temperature. * Can be used to replace all DD51 and DD52 stud mounted rectifiers. * Reverse polarity types available.

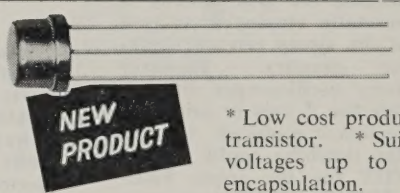
DT 3200 NPN POWER TRANSISTOR

* New cold-welded encapsulation for improved reliability at lower cost. * Gain range 15—45 at 3 amps. * VCB rating 45 and 80 Volts. * Silicon performance and reliability at germanium prices. * Suitable for use in Lf medium power professional applications. * Economical to use in Industrial and control applications. * Provided with special mounting clamp for use on heat sinks.



DT 4100 NPN POWER TRANSISTOR

* Higher collector currents at lower prices.



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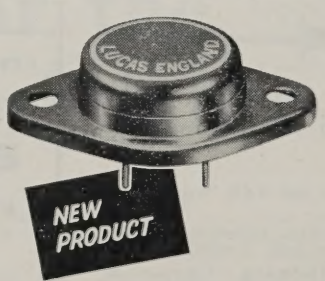

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the 11th new zealand science conference

As this issue goes to press, the Editorial Staff of this Journal are attending the 11th New Zealand Science Congress of the Royal Society of N.Z., which is being held on this occasion at the University of Auckland.

This Congress aims at bringing together Scientists of the various disciplines for their mutual understanding, and in addition, to give interested members of the general public the opportunity of learning something of Scientific Development and Research which is being accomplished in the various research facilities in this country.

Technical men, and women too, in their hundreds, have come from all parts of this country, and quite a large number of them have travelled from overseas to listen to or deliver over 300 technical papers on subjects ranging from geology to aurorea, from fishing to surgery, from radio-isotopes to the habitats of foreign races. Many of the official guests have stated from the platform that, in an environment such as we have here, there should be, and must be, an opportunity for the scientist and the layman member of the general public to become better acquainted. Whilst this is a vital necessity, it must be remembered that, although many commercial interests and members of the general public only look upon scientific research as a means of directly obtaining something of benefit, there have been countless cases, where modern technological and commercial advances produced today are the outcome of the work carried out by the pure research scientist up to a decade or more ago. It has proved very difficult in the past to bring out the salient points of pure research for the benefit of the layman.

We hope that in the next few months, this Journal, this Country's own Electronics publication, will contain some of the papers which have been presented at the 11th Science Congress. Some of these may tend towards, and some have, practical applications; whilst others discuss pure research work which is being carried out in various parts of the country. In addition to bringing this material to the notice of our readers, we also hope that these articles will stimulate potential authors to write about other work being carried out. By the publication of these articles, our readers will discover, as we have done, that there is much being done in this small country, which, although not being carried out behind closed doors, is certainly not knowledge that is being widely disseminated.

With the general Government policy of encouraging educational advancement, coupled with greater, more efficient, and more diversified primary and secondary production, we feel that this Journal can play its part in bringing to the members of the Electronics industry and profession, some of the current technological advances, but, and this is a very big but, this cannot happen unless the people who are doing this work are prepared to spend a little of their very precious time, in putting pen to paper, for the benefit of the other scientists both in this country and overseas. We should not need the stimulus of a national Congress to produce such material.

ENQUIRY CARD AD. 8

NOW IN PRODUCTION AFTER 12 MONTHS DEVELOPMENT AND TESTING

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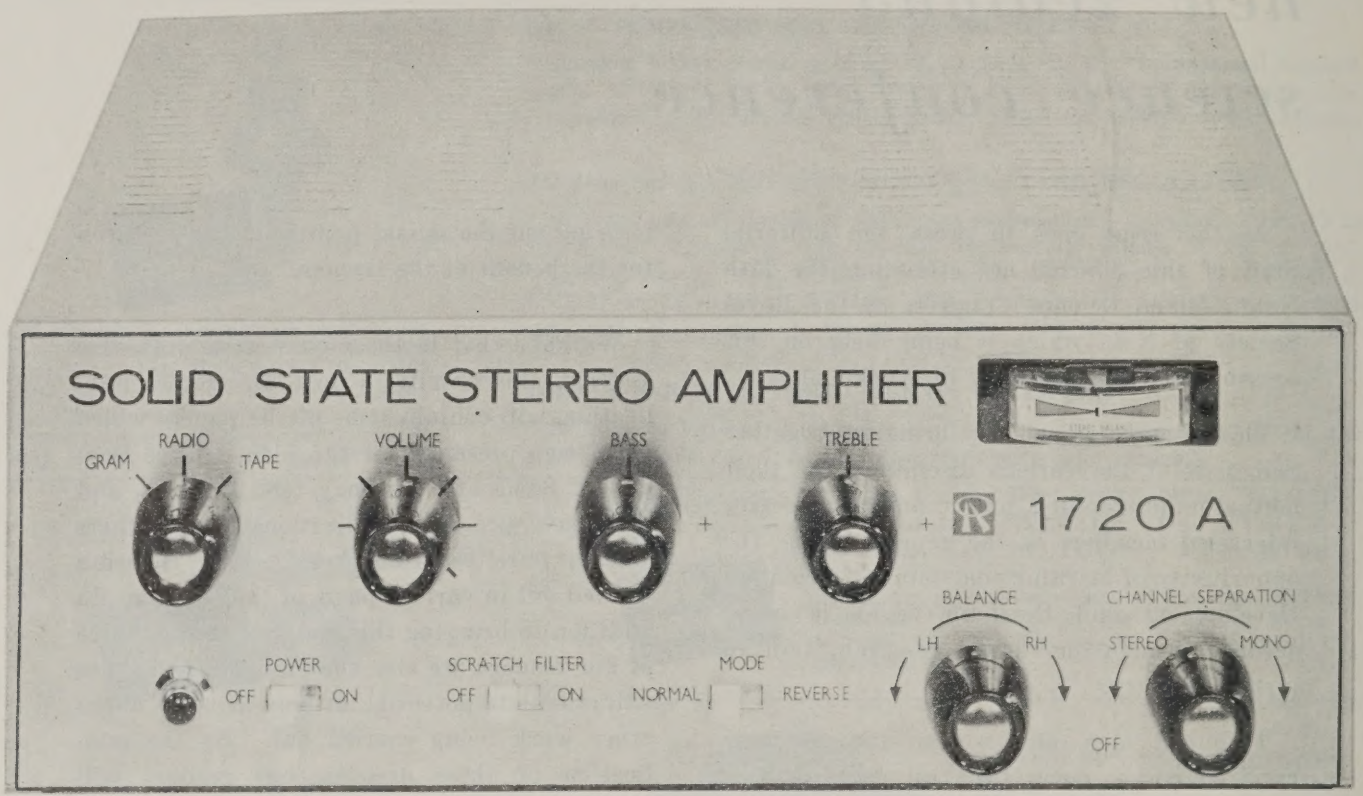

COMPLETE UNIT, EXCEPT PANEL CONTROLS, GUARANTEED FOR TWO YEARS

Basic unit shown is designed for crystal pickup. Magnetic pickup users require accessory model 1720B solid state R.I.A.A. head amplifier. Complement, 17 transistors, two silicon temperature diodes, 2 silicon power diodes, 1 silicon zener diode, 2 thermistors. No output or driver transformers used. Case — black or grey vinyl coated steel. Brushed stainless steel control panel. Controls as illustrated, balance meter. Zener diode stabilised power supply. Constructed from circuit board modules.

SPECIFICATION OF AVERAGE AMPLIFIER

R.M.S. POWER OUTPUT— 20 watts continuous sine wave with 8 ohm loads, 24 at clipping point
DISTORTION— At rated output 1kc/s .5 to .7% radio input
NOISE— S/N ratio main amp 70dB through radio input, 52 to 59dB
TONE CONTROLS— Bass –9 to + 20dB at 50 C.P.S., treble –9 to + 20dB at 10kc/s
FILTER— –9dB 10kc/s
RESPONSE— Controls flat through radio input 2dB 27 C.P.S. to 27kc/s
INPUT— Tape 1.5V radio 900mV P.U. 330mV
OUTPUT— 4 to 15 ohm voice coils

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THE R. E. & C. 6" EXPERIMENTER'S Tv. RECEIVER

Part 3

by Irving Spackman, ZLIMO

I.F. Strip Alignment and Picture Tube Circuity

Last month we discussed the coils for the I.F. strip together with details of the synchronisation and generation of the voltages used for deflecting the beam in the cathode ray tube.

Before we pass on to discussing the alignment of the I.F. strip we offer a few words of warning to those who are contemplating winding their own coils, particularly in the light of some of the experiences we have heard.

The coil formers we have used and recommended are made from black plastic and can be deformed or even broken if subjected to excessive pressure or heat. When winding the coils, do not use any more force than necessary and do not wind the wire under more tension than is needed to maintain the wire neatly in place, until the coils can be given a coat of "coil dope" to permanently hold the winding.

The best way to wind the coils is to rotate the former between the thumb and forefinger of one hand whilst feeding and gripping the wire with the other.

If the former is distorted there is quite a possibility that the cores will not be capable of easy adjustment inside the former.

In the base of the former there are 4 eyelettes and 4 other holes without eyelettes as well as the larger central hole through which the tuning core is adjusted. Two of the smaller non-eyeletted holes are threaded for 6BA screws and these should line up with the holes in the tabs in the base of the shield can when it is assembled on to the former.

The ends of the wires of the winding should be identified as per the drawings published last month and then cleaned for about two inches beyond the point where they are fed through the eyeletted holes which can be identified by the numbers moulded into the plastic along side them. The wires are then quickly soldered into the eyelettes, and allowed to cool.

The finished coils can now be assembled into the shield cans, and once again care should be exercised. The tops of the formers are made slightly smaller in diameter than the body of the former so that a top mounting and spacing plate can be fitted where necessary. This reduction in diameter also enables the former to fit into a recess pressed into the top of the can. Once assembled, the two small tabs on the side of the can are bent up over the threaded holes, against the base of the former. Make sure that there is no undue pressure on the former when it is finally assembled, otherwise it could be bent or otherwise distorted or broken.

This is really about all we can say concerning fabricating the coils. The diagrams will give you clear instructions about the exact position of the windings and their connections.

Turning now to the construction of the I.F. strip, it is quite important to mount the valve sockets and coil cans on the strip so that the shortest possible leads are used to connect them together. See that the earth points associated with each stage are all connected to the same solder lug, which is mounted under one of the screws holding the tube socket. In no circumstances should the by-pass capacity for one circuit be earthed to a solder point used for the one prior or after, in the chain, otherwise you may run into problems of instability. The chances of instability will, of course, be least with the two-stage "local station" I.F. strip and greatest with the 4 stage "Fringe region" strip purely because of the higher overall gain of the latter.

The earth points in question are those of the grid circuit coil return, the screen, (which is also the anode) by-pass, and the cathode by-pass. Whilst it should not be strictly necessary to earth the cathode bias resistor to this point, it will in practice by most convenient to do so. All capacitors, as specified should be either disc ceramics up to .01 mfd. in value, and polyester types for higher capacitances.

Some of the coils which are shunted by resistances use these to flatten their response. We have found that 10k ohms required in 2 of the circuits whilst 4.7k ohms was required in another.

Readers will have noticed in the circuits that we have not specified alignment frequencies for each coil. The reason for this will become apparent as we discuss the alignment details particularly in view of the fact that the I.F. strip can use 2, 3 or even 4 amplifying stages, depending on the particular location where the receiver will be used.

I.F. Strip Alignment Frequencies

We mentioned in our first part of this article that the ideal method of alignment is to use a sweep generator and oscilloscope. However, we realise

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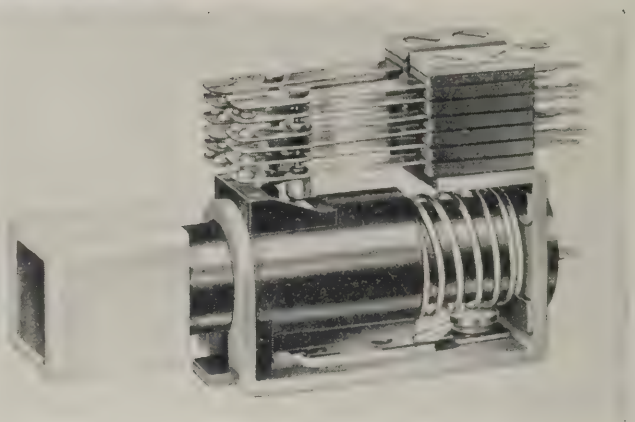

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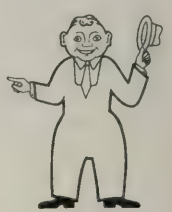

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that many of our readers will not have access to these, but even if they are available and used, it is still necessary to have some indication of the frequency of each tuned circuit to start with.

In the first part of this series, we pointed out that we have used a bi-filar wound coil in some locations. This behaves as though it is only a single tuned circuit as far as alignment is concerned. We will now outline how the preliminary frequencies are determined. We intend taking a little space to explain this part as we feel that a thorough understanding of the method used for determining the frequencies for alignment will enable the experimenter to get the best from his I.F. strip, when he knows what is likely to happen when a particlar "slug" is adjusted or a resistor across one of the coils is altered in value. To determine the tuning frequencies, all that is required is a little patience, a piece of linear graph paper, and a compass, plus a smattering of simple algebra.

The first requirement is for the constructor to determine how many stages will be required in the strip. For the purpose of description, we have settled upon 3 amplifying stages as being the most likely common design.

The I.F. frequencies which correspond to the sound and vision carrier frequencies of the TV. transmission are determined by the frequency of the local oscillator in the TV. tuner. In practically every case, this is higher in frequency than the TV. channel by an amount equal to the I.F. frequency.

The N.Z. Standard I.F. Frequencies are sound carrier 33.4Mc/s, vision carrier 38.9Mc/s. The reader will note that whilst the vision carrier frequency is lower in the particular TV. channel (e.g. Channel 2 vision 55.25Mc/s, sound 60.75Mc/s) the relative position of the two carriers is reversed in the I.F. channel because of the frequency of the local oscillator.

I.F. Strip Frequency Response

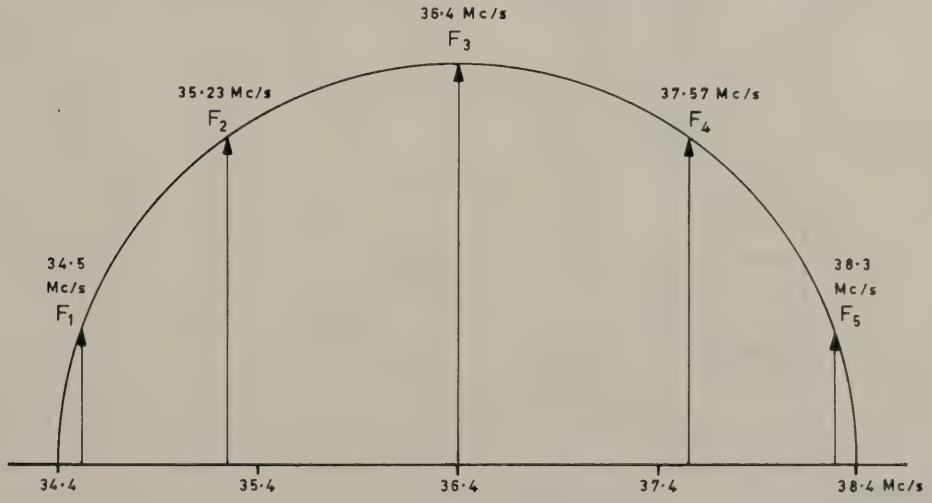
For correct performance of the I.F. strip, the amplification versus frequency curve should have a particular shape.

If we look at a graph of this curve we would see the following information:—

The region between 35.0Mc/s and 38.0Mc/s should be nearly flat and the curve should only be 3dB. down (.707 of the reference voltage) at 34.4Mc/s and 38.4Mc/s. At 33.6Mc/s the curve should be 26dB down (1/20th of the reference voltage), whilst at 33.4Mc/s, (the sound I.F. carrier frequency) the curve should be at least 20dB down, but in any event should be slightly higher than the frequencies either side (this is called the sound plateau). The curve should drop to zero reference at 33.2Mc/s. At the other end of the curve, the graph should be 6dB down ($\frac{1}{2}$ the reference voltage) at 38.9Mc/s (the vision I.F. carrier frequency) and maintain a steady downward slope to drop to zero at about 40.4Mc/s.

As can be seen from this data, the frequency coverage between the 3dB points is 4 megacycles, with suitable shaping either side out to the limits of the 7 megacycle handwidth. If we can initially select the I.F. tuned circuits to give us this 4 megacycle region, we can then introduce the trap circuits to shape the curve in the correct manner.

FIG. 4 METHOD OF DETERMINING FREQUENCIES FOR STAGGER-TUNED I F AMPLIFIER - USE IN CONJUNCTION WITH TEXT.



THE BANDWIDTH OF EACH TUNED CIRCUIT= TWICE THE HEIGHT OF THE PERPENDICULAR ON THE SAME SCALE. E.G. F_1 AND F_5 = 0·65 x 2 Mc/s = 1·30 Mc/s.
F_2 AND F_4 = 1·65 x 2 Mc/s = 3·30 Mc/s
F_3 = 2·0 x 2 Mc/s = 4·0 Mc/s

THE DIAMETER OF THE CIRCLE IS THE BANDWIDTH OF THE AMPLIFIER AT NORMAL ATTENUATION FIGURE OF SAY 3 dB.

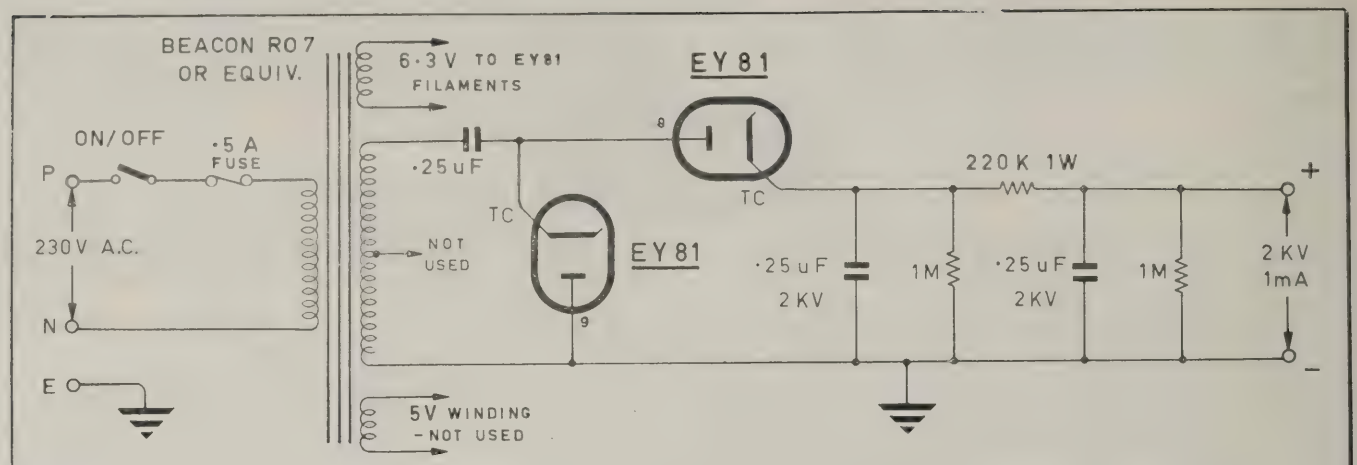


FIG.1 CIRCUIT TO PROVIDE POSITIVE VOLTAGE OUT, WITH NEGATIVE LEAD EARTHED.

FIG.2

NOTE: BOTH THESE POTENTIOMETERS SHOULD BE MOUNTED ON INSULATED PANEL WITH INSULATED SHAFT EXTENSIONS

FIG.2: ALL FIXED RESISTORS ARE 1 WATT UNLESS OTHERWISE STATED

NUMBERS INSIDE CIRCLES REFER TO SOCKET CONNECTIONS - SEE FIG.3.

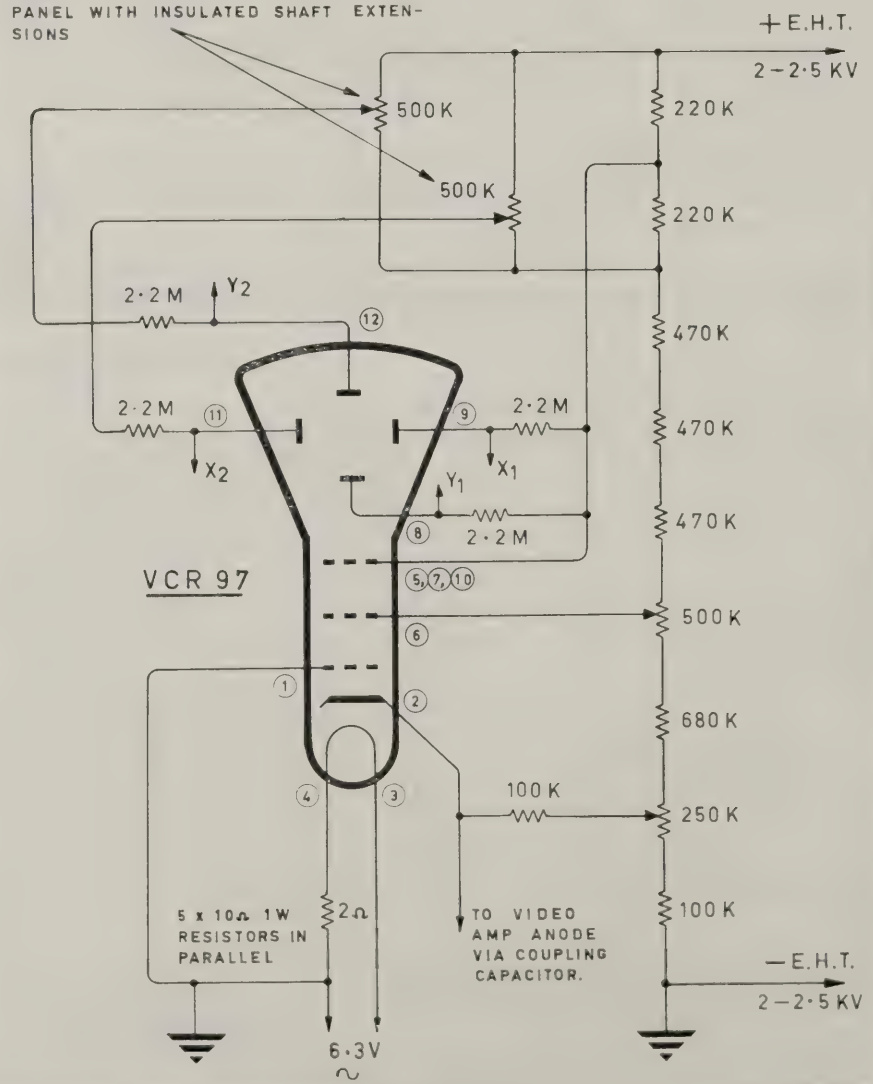
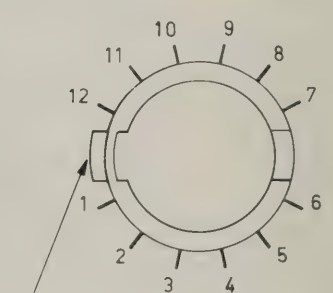


FIG.3. PIN CONNECTIONS TO VCR97 SOCKET WHEN LOOKING AT SOCKET FROM FRONT OF CHASSIS, WITH TUBE REMOVED AND SOCKET MOUNTED AS SHOWN.



MOUNT SOCKET WITH SPIGOT TO LEFT-HAND SIDE.

NUMBERS REFER TO FIG.2 - SEE ALSO TEXT.

Let us now consider Fig. 4. We select a bandwidth of 2 megacycles either side of the centre frequency of 36.4 megacycles. At the 3 dB point, i.e. 34.4 and 38.4Mc/s we draw, using the baseline, a semi-circle. Using the compass, by simple trial, we then divide the semi-circumference into the same number of equal parts as there are tuned circuits in the I.F. strip, plus the one in the output of the tuner, i.e. 5. At the centre of each of these divisions we drop perpendiculars to the base line. The frequencies indicated by the feet of these perpendiculars are the centre frequencies of the five tuned circuits. It is now necessary to determine the bandwidth of each of these tuned circuits. This is equal in megacycles, to twice the height of the perpendicular between the base line and the curve, providing the same scale calibration is maintained. For example, the centre frequency is 36.4 megacycles with a bandwidth of 2 x2 Mc/s = 4 Mc/s. In the case of this particular I.F. strip, we have one coil tuned to 36.4 megacycles, bandwidth 4 Mc/s; 2 tuned circuits each 3.3 megacycles bandwidth located at 35.2Mc/s and 37.6Mc/s; and two more tuned circuits each 1.3 megacycles wide located at 34.5Mc/s and 38.3Mc/s respectively.

Calculating the Damping Resistances

Now the next point to cover is how we can determine the damping resistance if any, to be placed across the coil, so that the coil will cover a certain required bandwidth, and it is at this point that we turn to a little simple mathematics.

It can be shown that the Q factor of a coil which is required to cover a certain band of frequencies is equal to

$$\frac{\text{Centre Frequency of Coil}}{\text{Bandwidth required}}$$

Taking our centre frequency of 36.5Mc/s, to cover 4Mc/s, we have

$$Q = \frac{36.4}{4} = 9.1$$

Similarly for the other design frequencies

$$Q = \frac{34.5}{1.3} = 26.5$$

$$Q = \frac{35.2}{3.3} = 10.5$$

$$Q = \frac{37.6}{3.3} = 11.4$$

$$Q = \frac{38.3}{1.3} = 29.5$$

At the frequencies we are using, and with present day vacuum tubes, any damping effects due to the tubes will be small, but must be considered. For example the input resistance of an EF80 at 50Mc/s is in the vicinity of 10k ohms, an EF85 is quoted at 9k ohms whilst an EF183 has an input resistance at 40 megacycles of 13k ohms and an EF184 has a 10k ohm input resistance also at 40 megacycles. Also, the damping on the last I.F. transformer by the diode load will be appreciable, being approximately equal to the value of the diode load.

Now the dynamic resistance, R of a tuned circuit is equal to

$$\frac{Q}{2\pi \, foC}$$

where Q is the figure we have just calculated: fo is the centre frequency in cycles per second; C is the total capacitance across the coil including strays in farads. In the case we are discussing, C can be taken as approximately 15 pf. i.e. 15 x 10^{-12} farads. Our formula now becomes, where Q = 9

$$R = \frac{9}{2 \times 3.14 \times 36.5 \times 10^6 \times 15 \times 10^{-12}}$$

$$= \frac{9}{6.28 \times 36.5 \times 10^{-6} \times 15}$$

$$R = \frac{9 \times 10^6}{6.28 \times 36.5 \times 15}$$

does not equal 2700 ohms.

The values for R for the other 4 values of Q are

$$R = \frac{26.5 \times 10^6}{6.28 \times 34.5 \times 15}$$ does not equal 8.2k ohms

$$R = \frac{10.5 \times 10^6}{6.28 \times 35.2 \times 15}$$ „ 3.2k ohms

$$R = \frac{11.4 \times 10^6}{6.28 \times 37.6 \times 15}$$ „ 3.2k ohms

$$R = \frac{29.5 \times 10^6}{6.28 \times 38.3 \times 15}$$ „ 8.2k ohms

From these figures, we can see that the dynamic impedance of the two tuned circuits closest to the edge of the bandpass curve should be approximately 8.2k ohms; the two tuned circuits further from the edges should have a dynamic impedance of 3.2k ohms, whilst the one in the centre of the bandpass curve must be 2.7k ohms.

A coil of the type we are using will probably have an unloaded Q not much greater than 30 which at these frequencies will exhibit a dynamic impedance of the order of 9k ohms. Thus, to achieve 8.2k ohms total circuit impedance using a 9k ohm coil, together with the effects of the tube associated

with it, we need not add any damping resistance. To produce a tuned circuit with a total impedance of 3.2k ohms, with our basic unloaded coil impedance of 9k ohms, plus the loading of the associated tube of the same order, we must shunt it with a parallel resistance so that the total equals 3.2k ohms. In this case a 10k ohm resistor fills the bill admirably, and one of this value will be found connected across two coils in the circuit of Page 14 of the November 1964 issue.

Readers will note in reference to this circuit that the optional 3rd stage is shown without any damping resistance connected across the coil. The reason for this should now become apparent.

Note: In the case of the three stage strip the diode load for the video detector should be 2.7k ohms. The 4.7k figure shown in the circuit (P.14 November 1964 issue) is applicable only in the case of the 2 stage I.F. strip as shown.

At this juncture we can finalise the frequency allocations for the I.F. strip coils.

Tuner output coil — 38.3Mc/s.
L1 1st stage of strip — 34.5Mc/s.
L2 sound trap — 33.6Mc/s.
Coil between V3V4 — 37.6Mc/s.
Coil between V4V5 — 35.2Mc/s.
Coil V5 and detector — 36.4Mc/s.

The frequencies quoted above in the tabulation are not final irrevocable figures. They are the starting point for signal generator or sweep generator alignment and some minor adjustment is likely to be required to produce a perfect selectivity curve. Nevertheless, alignment to these frequencies will undoubtedly provide a picture of reasonable quality.

The Practical Details of Aligning the I.F. strip

Having decided what preliminary frequencies will be used the next point is to get on with the job. At this stage, we assume that the reader hasn't access to a wobbulator or sweep generator and an oscilloscope. The equipment required is simply (1) a signal generator covering the range 30-40 megacycles, preferably with dial calibration capable of interpretation to .25 of a megacycle or better. It does not need to be modulated however. (2) A multi-meter capable of reading 0-1mA or 0-5mA or better still a V.T.V.M. with high resistance D.C. probe.

We will assume that only the milliampmeter is available. This is connected in series with a 1k ohm resistance and the earthy end of the 2.7k ohm diode load which is by-passed temporarily with a .1mfd capacitor. This is to prevent the meter or its leads having any effect on the tuning of the last coil.

The A.V.C. Line should be removed from the video detector diode and connected to the negative terminal of a 1½ volt battery. The positive terminal of course, should be earthed.

The generator is first coupled into the grid of V5, with the grid connection of the previous coil removed and a 4.7k ohm resistor connected in its place to the earth point. This generator is set to the correct frequency, in this case 36.4Mc/s and the output increased until ½mA or so is indicated on the meter. The slug in the coil between V5 and detector is adjusted for maximum deflection on the meter. The generator is now moved to the grid of V4, with the coil between V3 and V4 removed and the 4.7k resistor again temporarily connected. Don't forget to replace the connection to V5. In this case the generator output may need to be reduced somewhat to keep the needle in the middle of the scale; the frequency set to 35.2Mc/s and the coil between V4 and V5 is adjusted again for maximum meter deflection.

The same technique is applied with the generator connected to the grid of V3. Once the coil between V3 and V4 has been aligned, the connections to V3 are restored and the generator is now coupled into the input of the strip, connected across the coaxial lead, which ultimately connects to the I.F. output from the tuner. Now temporarily disconnect the 50 pf capacitor across L2, (this will detune it completely) and adjust L1 to the correct frequency. Once this is done, then the 50pf capacitor can be reconnected, the generator tuned to 33.6Mc/s and the trap adjusted this time for **minimum** signal level on the meter. The tuner should now be connected (assuming a commercial model is being used) and the signal generator connected to the specified test point in the tuner. With power applied to the tuner, the signal generator tuned to 38.3Mc/s, the output coil in the tuner should be adjusted for maximum signal on the meter.

The signal generator output should now be set so that with the frequency set to 36.4Mc/s the meter should indicate say 1mA. By slowly sweeping the generator backwards and forwards and noting the meter reading, the general shape of the curve can be assessed. It is generally quickest in the long run to take ½ megacycle intervals and plot the meter current on a sheet of graph paper. Inspection will then indicate which coils may need adjustment to correct the shape of the curve and bring it up to standard. In very stubborn cases it may be profitable to modify the value of one or more damping resistors to increase or decrease the influence of a particular winding, but if any great variation is needed then start from scratch and retune all the coils again. Watch particularly for false peaks in alignment due to erroneous tuning of a particular coil. If the final curve is checked by "sweeping" the generator shows gross errors or if there is a tendency to oscillation or instability, then check this point carefully.

Once the alignment is to your liking, fix the cores with locking compound as vibration can soon upset a good alignment. As with most jobs of this kind the more time and care taken over the job, the better the final result will be. Don't forget to restore the A.V.C. line and remove the bias battery.

Aligning the Sound Channel

Lining up the sound channel of the receiver is quite simple by comparison with the vision I.F. circuits. Here again the wobbulator is the best way to line up the sound channel, but using the EH90 gated beam discriminator, a signal generator will do the job nearly as well. However, a VTVM or 20,000 ohm per volt multimeter is also required. The generator is set to 5.5Mc/s and coupled into the input of the EF184 video amplifier, after lifting off the lead from the detector, and again substituting a 4.7k resistor from grid to ground. The VTVM or multimeter is coupled across the 1mfd capacitor at the earthy end of the coil L10 and L7, then L8, L9 followed by L10 are adjusted for maximum voltage on the meter. After the meter is removed, particularly if a multimeter is used, then L9 and L10 can be touched up for best sound quality on an actual transmission.

This concludes this part of the discussion on alignment of the I.F. strip. If a TV. antenna is connected and the tuner set to the correct channel then the sound can be touched up, and some indication of the signal level available can be gained by measuring the A.V.C. voltage being developed.

The E.H.T. and Deflection Voltages

This month we are also publishing the circuit details in Fig 1 of the Picture tube power supply, together with the voltage divider network to produce the correct operating voltages for the electrodes of the VCR97.

Several points should be kept in mind concerning this section of the receiver. The EHT of 2,000 volts is **lethal,** so don't take any risks whatsoever. The best place for the voltage divider network is mounted on an insulating strip lying in the area underneath the picture tube neck. Build the EHT power supply in a well insulated box and bring out the EHT leads either in ignition type cable, or good quality PVC insulated stranded hookup wire covered with a good make of spaghetti insulation.

Both the shift potentiometers are also at the high voltage end of the divider chain. These should be mounted on an insulating panel, away from possible contact, and operated from the front panel by an **insulated** extension shaft. Also, do not use a variety of control knob which has the grub screw exposed to the touch.

At this point we would like to bring to light a few points with respect to the VCR97. In our circuit for the picture tube, we have shown pins 5, 7, and 10 connected to virtually the full H.T. This may appear to be in variance with other circuits published which show no connection to Pins 7 and 10. Back in 1958 there was considerable amount of discussion overseas regarding the various types of VCR97s that were in circulation. However, basically there are 2 main patterns but there can be versions of one with some of the characteristics of the other and vice versa.

The first basic pattern has a commercial number allocated to it. This type ECR60, has its number 1 anode and internal graphite coating connected to the number 3 anode, which is usually connected to Pin 10, whilst Pins 3 and 5 are blank. The data for this tube made by Mullard has heater 4v at 1 amp; Va1 — Va3 — 2500v max.; Va2, 260-450v; Vg -1 to -100v.

Tubes made by this firm can generally be distinguished if the type number is missing, by the blank base pins, evident when the base cover plate is removed by unscrewing the two retaining screws. The deflection plates, also are flat sheets of metal supported on a fairly light framework, and therefore probably due to a jar or bump, the deflection plates may have moved out of line. Many of these tubes, for this reason have restricted deflection angles such that any attempt to deflect the spot over the whole screen width either in one or both directions, results in the beam striking the deflector plate.

In some cases, tubes with poor deflection in one direction, can be utilised by using this direction as the vertical scan. This may involve the horizontal amplifier in driving the less sensitive plates, but as we have adequate deflection voltages, this may not be too serious a problem.

The second type of VCR97 is apparently patterned on the GEC design which has the type number E-4504 - B - 16. This has a 4v filament at 1.1 amps, Va1 = 2,500 max., Va2 = .175 x Va3; Va3 = 5000v max., 1,000v minimum; Vg = -(Va1 x 0.04v) max.

In this tube the 1st anode is brought to Pin 5 with separate internal coating on Pin 7, although we have had, in our possession, tubes with both an internal connection for A1 and Pin 5 blank, and an internal connection for Pin 7 and this pin blank. In some cases, the wires are actually joined together in the base, and this can easily be determined by removing the base plate.

Generally speaking, this tube has a connection to all base pins, while the deflection plates are more highly polished, and often slightly dished in shape. The supporting structure is more solid in appearance and in some cases, some of the leads are supported and insulated with glass tubing.

This second variety of tubes have a slightly wider neck than the ECR60 series, which were a nominal 2½'' in diameter. This then is the reason why we have tied Pins 5, 7 and 10 together and connected it to nearly the full HT voltage.

One interesting point has cropped up with some of these tubes, which may have laid in stock for more than 20 years. This is an initial scanning trouble which clears up after a few hours operation. Initially there are gaps present in the raster adjacent to the area near the deflection plates, which gradually decrease and finally disappear after a few hours of use. We have mentioned this point because a potentially good tube could be rejected for this reason.

At this point we shall leave the subject for this month. Next month in the final article in this series we will discuss the details of a simple station tuner.

Medium Power Semiconductor Rectifiers

Part II

The September 1963 issue of this journal gave brief details of the various single phase rectifier circuits in use and in this issue our contributor deals in greater detail with some of these circuits. Ideal circuits will be dealt with so that a knowledge of the theoretical considerations can be used in the practical cases to be viewed in the third, and concluding, part next month.

SINGLE PHASE RECTIFIER CIRCUIT

Whilst three phase rectifiers are undoubtedly superior from efficiency aspects the limitation of availability of three phase supply rules out any consideration of these in this review as three phase supply is usually only found in industrial premises and is in fact, only used for rectifiers higher in rating than those considered here.

Four forms of single phase rectification are common:—

(a) half wave
(b) centre tap full wave (bi-phase)
(c) full wave bridge
and
(d) voltage doubling.

The circuits for these are shown in figure 1 — the lower two being the two usual forms of voltage doubling. Circuits (a), (b) and (c) will be considered as voltage doubling is not usually used in medium power work but is quite common in low power electronic equipment such as television sets and photo-flash equipment.

Each circuit has advantages and disadvantages and the choice of a particular circuit is usually dependent upon application. In our considerations ideal, or perfect, circuits and components will be dealt with. The rectifier will have no forward or reverse loss and there will be no voltage drops in associated components such as transformers, inductors and capacitors. Transformer input and output voltages will be considered as perfectly sinusoidal. The practical considerations of less-than-perfect circuits and components will be dealt with later and this later discussion will include the subject of transformer design specification. **Resistive loads** only are considered initially.

DEFINITIONS

It is important that the terms usually associated with rectifier engineering should be understood and the principal are:—

1. **Crest Working Reverse Voltage** (CWV) or Peak Inverse Voltage (PIV) is the peak value of the voltage appearing across the cell in the reverse direction.
2. **Average or mean value** (of the waveform) is the mathematical average value of the points on the waveform (in vertical scale). The waveform can be current voltage or power and varies with respect to time.
3. **Root Mean Square (RMS) value** or effective value (American term) is the square root of the average of the squares of all (vertical) points on the waveform. In practice, one view is that on RMS (alternating) current through a resistor is that amount of current that will produce the same heat as an equivalent direct current
4. **Form Factor** of a waveform is the ratio of RMS value to the average or mean value.
5. **Ripple Factor** is the ratio of RMS value of the **A.C. component** to the average value.
6. **Current and Voltage Factors** are the ratios of the RMS values to the direct values at the load.

Mathematical Determination of Values

The instantaneous value of a sine wave (of voltage, or current) is given by $e = E_{max} \sin wt$ $(W = 2\pi f)$

To arrive at the RMS value squaring is necessary thus:—

$$e^2 = E_{max}^2 \sin^2 wt$$

it can be shown that this becomes

$$e^2 = E_{max}^2 \times \tfrac{1}{2} (1 - \cos 2wt)$$

$$= \frac{E_{max}^2}{2} - \frac{E_{max}^2 \cos 2wt}{2}$$

of this $\frac{E_{max}^2}{2}$ is constant with respect to time and the second term has sinewave form and its average value over a whole cycle is zero

$$\therefore \text{mean value } e^2 = \frac{E_{max}^2}{2}$$

and $E_{RMS} = \sqrt{\text{mean value } e^2}$

$$= \frac{E_{max}}{\sqrt{2}}$$

also $I_{RMS} = \frac{I_{max}}{\sqrt{2}}$

$$= .707 \, E_{max}$$

For a half sine wave (0° — 180°) the mean or average value

$$= .637 \, E_{max} \left(\frac{2}{\pi} E_{max}\right)$$

The form factor for a sine wave

$$= \frac{RMS}{\text{average}}$$

$$= \frac{.707}{.637}$$

$$= 1.11$$

THE SINGLE PHASE HALF WAVE CIRCUIT

This is the uppermost circuit of figure 1 and in this circuit the sum of the voltages in the loop is zero.

$V_{in} + V_{out} + V_{across\ rectifier} = 0$

(Note that in this instance the rectifier voltage is considered) thus:—

An article from the National Audiology Centre of the N.Z. Department of Health.

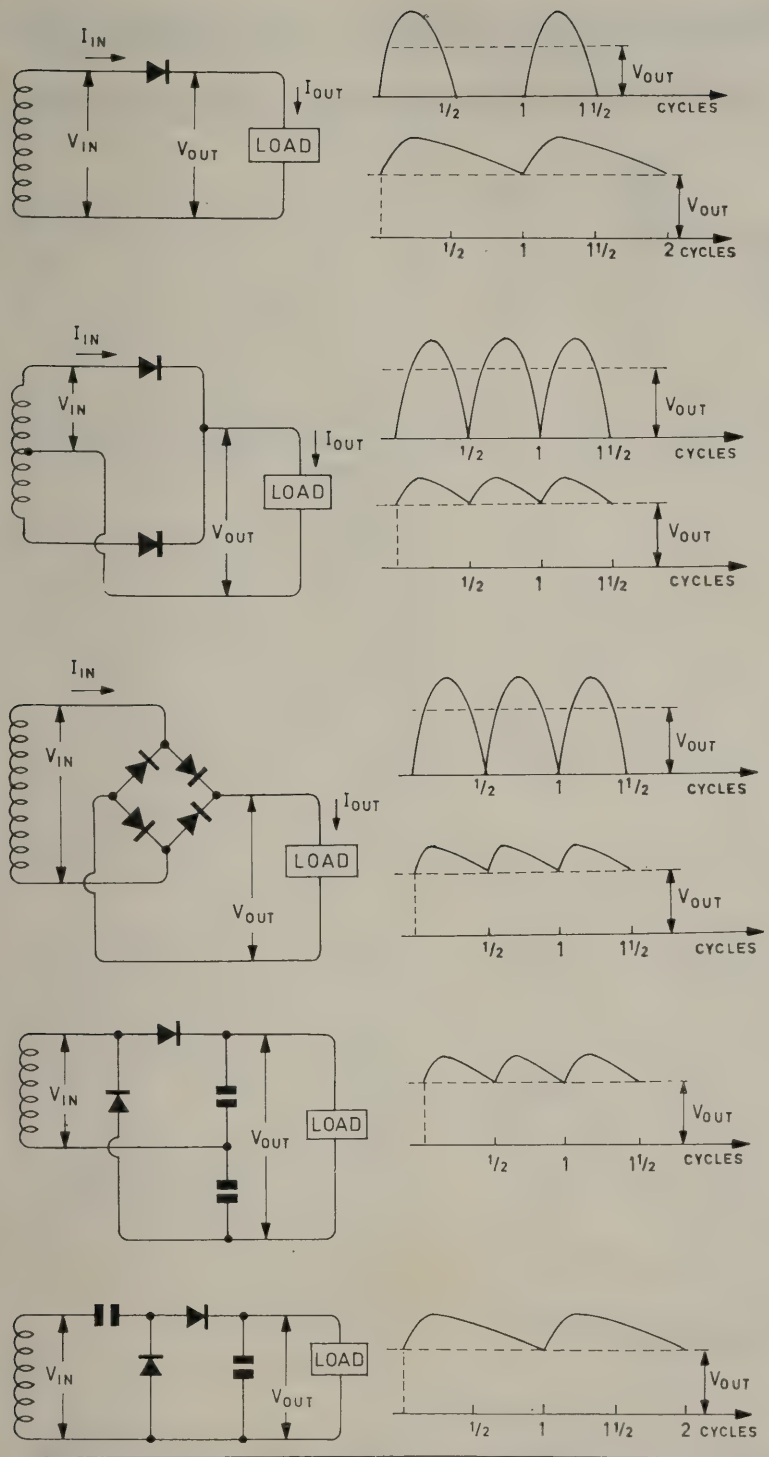


FIGURE 1

The reverse voltage across the cell equals the supply voltage plus the load voltage.

Mathematically it can be shown

Vout D.C. = .318 Emax

The **Voltage factor** as defined

$$= \frac{\text{E RMS}}{\text{E DC}} \text{ or } \frac{\text{Vin (RMS)}}{\text{Vout}}$$

$$= \frac{.707\ \text{Emax}}{.318\ \text{Emax}}$$

$$= 2.22$$

The **Form factor** (FF)

$$= \frac{\text{RMS}}{\text{mean}}$$

becomes = 1.57

as does the **Current factor**

The **Ripple factor** is 1.21 and can be shown to be

$$\sqrt{(FF^2 - 1)}$$

THE CENTRE TAP FULL WAVE CIRCUIT

This is shown as the second circuit in figure 1 and on alternate half cycles each rectifier conducts their blocks. Thus. on each half cycle the load receives the voltage from a "half" winding.

The voltage factor is, therefore the same as for a half wave bridge. Each rectifier is required to block 2 x Vin.

The waveform of this circuit becomes easy to visualise if the load is considered as being fed by two half wave rectifiers but being fed, by one or other, at all times during a full cycle. For this circuit it can be shown.

Vin = 1.11 Vout D.C.
Voltage factor = 2.22
FF = 1.11
Current factor = .786
Ripple factor = .48

Whereas for the half wave circuit the ripple frequency is 50 cycles the ripple for the C.T. connection is 100 cycles.

THE FULL WAVE BRIDGE CIRCUIT

In this circuit both halves of the input cycle are rectified simultaneously.

The voltage factor now becomes 1.11.

The current factor is 1.11 and the form factor 1.11 with the ripple factor remaining at .48.

In medium and high voltage applications the CWV (PIV) becomes a more reasonable value at 1.414 Vin as against twice this value for the C.T. circuit and half wave bridge for the same D.C. output voltage.

RECTIFIER CELL CURRENT

A further consideration, especially of practical interest is the current through each rectifier cell and these values are tabulated thus in terms of D.C. current through a resistive load:—

	½ Wave	C.T.	Fuel Wave
Av. Current per cell	I D.C.	.51 I D.C.	.51 I D.C.
I RMS per cell	1.57 I D.C.	.785 I D.C.	.785 I D.C.
I peak per cell	3.14 I D.C.	1.57 I D.C.	1.57 I D.C.

UTILITY FACTOR

Another factor affecting the choice of a rectifier circuit is the rating of the transformer measured against the D.C. power output into the load.

A utility factor of unity would be possible only if the transformer was supplying sinusoidal output and as no rectifier allows sinusoidal current to flow the utility factor must always be less than one.

Values for the circuits under consideration are:—

Half wave	.286
C.T.	.67
(some variation	possible)
Full wave	.813

PRACTICAL CIRCUIT CONSIDERATION

Usually the choice of a rectifier circuit will depend upon the cost of the whole unit — rectifier cells and transformer. Of these two the transformer will nearly always be the more costly so that some knowledge of the rating of the transformer may be required before finally selecting a particular circuit.

In circuit choice some readers may find it necessary to overcome prejudice. Those used to Aemrican rectifier practice will probably favour half wave and centre tap circuits whilst Anglophiles will be used to full wave bridge circuitry.

In considering transformer requirement we are still dealing with the theoretically ideal circuit. The addition of filtering elements and reactive loads has still to be looked at. Filtering elements are not yet dealt with as some applications, much as electroplating, do not require smoothing.

TRANSFORMER RATING

A few symbols are necessary:—

Vin RMS voltage into rectifier
Vs RMS voltage from transformer secondary
Is RMS transformer secondary current
Il RMS current in input line
Ve Mean voltage across load
Ie Mean current in load
W Power load = Ie + Ve
R Load resistance

The Half Wave Circuit

Whilst this circuit is seldom used without a capacitor there are some cases where resistive and inductive loads are used directly.

Previously $Vs = 2.22\ Ve$

$Is = 1.57\ Ie$

$VAs = Vs\ Is = 3.5W$

The secondary current has a D.C. component flowing through the winding that does not, however, appear in the primary

$Ip = \sqrt{(Is^2 - Ie^2)}$

$= Ie \sqrt{(1.57^2 - 1)}$

$= 1.21\ Ie$

Primary rating

$= 2.22\ Ve \times 1.21\ Ie$

$= 2.68W$

Mean rating = 3.09W

say 3W

(It is assumed that the transformer under consideration has a 1:1 ratio).

As both D.C. and A.C. flow in the secondary winding there may be some saturation of the core but an increase in core size can compensate for this.

The Centre Tap Circuit

In this connection the transformer secondary has two identical windings each with an output Vs. The secondary VA rating is, thus, twice that of each winding

$VAs = 2\ Vs\ Is$

$= 2\ (1.11 \times .785)\ Ve\ Ie$

$= 1.74W$

Whilst each secondary winding carries current for half cycle period the primary is fully energised for the full cycle

$VAp = 1.11 \times 1.11\ Ve\ Ie$

$= 1.23W$

mean rating = 1.48W

say 1.5W

The Full Wave Bridge Circuit

$Vs = 1.11\ Ve$

$Is = 1.11\ Ie$

As, for a 1:1 ratio transformer, primary and secondary are identical windings

$VAs = VAp = 1.11 \times 1.11\ Ve\ Ie$

$= 1.23W$

Having now dealt with the ideal circuits we find that the **Full Wave Bridge** is, theoretically, the one that makes most efficient use of transformer material and provides the simplest winding requirements in that no C.T. is required and that the secondary voltage is the lowest required for a given D.C. output. Its only apparent disadvantage is that four rectifier cells are required.

The C.T. connection has some advantage over the Bridge when the output is so low that only a single cell is required in each arm and that the reverse rating of the cell is such that it will withstand 2Vs in any case. In this case the possible increase in cost of the transformer is offset by the saving of two rectifier cells.

The Half Wave circuit has a similar advantage at low voltages with the added one that a tapped transformer can be used for dual or triple output. This is a useful feature often used on simple battery chargers for 6, 12 or 24 volt output. In such units transformer and cell cost are often outweighed by assembly costs and labour charges. Against this connection is the fact that the cell has to handle the full output current as against .5 (of it) for the other two connections. Generally, its application is limited in power engineering to battery charging as a ripple frequency of 50c/s is no disadvantage.

The best "ideal" cases have been given above and it is desirable to consider the effect of additional circuit elements such as filtering components and the modifying effect of a reactive load.

These, together with the reduction of the transformer and rectifiers to practical elements having losses, will be dealt with in the concluding article which will deal with a study of an actual design problem.

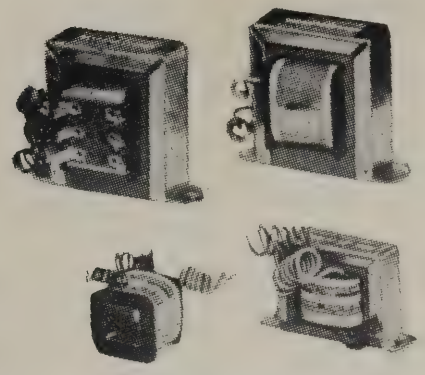
Italian Telescope Now In Use.

Northern Cross, the Italian Radio Telescope sited at Medicina and claimed to be the most powerful in the world, is now in use. The east-west arm of the telescope is 600 metres long and the north-south arm is 310 metres long. Work on the design of the telescope started in 1959.

The electronics of the instrument uses 1,000 valves and transistors.

OUTPUT TRANSFORMERS to your requirements

by ATC



We Manufacture many types of Output Transformers for New Equipment and Replacement Repair Work.
WINDINGS AVAILABLE FOR OP1-14 and OP18-22 INCLUSIVE

Type No.	Wattage	Impedance Ratio	Bobbin Size	Colour Code	Mounting
†OP1	3	5K/3 ohms	9/16 Square	Red	Clamp
†OP2	3	7K/3 „	9/16 „	Yellow	„
†OP3	3	10K/3 „	9/16 „	White	„
†OP3 C	3	10KCT/3 ohms	9/16 „	White	„
†OP4	6	5K/3 „	¾ Square	Red	„
†OP5	6	7K/3 „	¾ „	Yellow	„
†OP6	6	10KCT/3 „	¾ „	White	„
†OP7	6	14KCT/3 „	¾ „	Black	„
†OP8	4.5	5K/3 „	11/16 x 13/16	Red	„
†OP9	4.5	7K/3 „	11/16 x 13/16	Yellow	„
†OP10	4.5	10KCT/3 „	11/16 x 13/16	White	„
†OP11	4.5	14KCT/3 „	11/16 x 13/16	Black	„
†OP12	4.5	Universal	11/16 x 13/16	—	„
†OP13	6	Universal	¾ x ¾	—	„
†OP14	10W	Universal	⅞ x ⅞	—	„
OP15	20	5KCT/Univ.	1" x 1¼	—	Side covers & feet
OP16	20	6.6KCT/ „	1" x 1¼	—	„
OP17	20	10KCT/ „	1" x 1¼	—	„
OP21	2W	5K/3	½"	Red	Windings Only
OP22	2W	7K/3	½"	Yellow	„ „
OP23	35W	5KCT/Univ.	2" x 1¼	—	Covers & Feet
OP24	35	6.6KCT/ „	2" x 1¼	—	„ „
OP25	35	10KCT/ „	2" x 1¼	—	„ „
OP26	15W	Hifi 5KCT/15 ohms	2" x 1¼	—	„ „
OP27	15W	Hifi 8KCT/15 „	2" x 1¼	—	„ „
OP28	15W	Hifi 10KCT/15 „	2" x 1¼	—	„ „
		ULTRA LINEAR TYPE			
OP29	20W	6.6KCT/15 ohms	2" x 1¼	—	„ „
OP30	20	8.5KCT/15 „	2" x 1¼	—	„ „
OP31	20	10KCT/15 „	2" x 1¼	—	„ „

LOW POWER EXTENDED RANGE

OP32	6W	8KCT/7 ohms	1¼" x ⅞"	—	Clamp
OP33	6W	8KCT/15 „	1¼" x ⅞"	—	Clamp
OP34	3W	Universal	9/16 x 9/16	—	„
OP35	6W	10KCT/15-7.5-3 ohms	¾ x ¾	—	„
OP36					
OP37 / OP50	8W U/L / 10W stereo	9KCT/15-7.5-3 ohms	⅞" x ⅞"	—	„

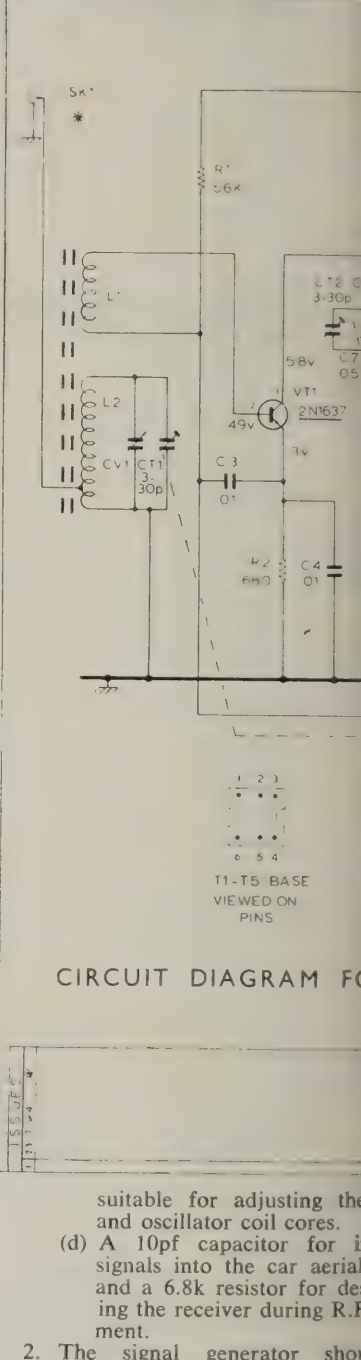
Auckland Transformer Co. Ltd.

20 EDEN STREET, NEWMARKET, AUCKLAND

TELEPHONE 51-307 — — — — TELEGRAMS: "TRANSFORMA," AUCKLAND

Abbreviations:
m.tub. — metallised paper tubular
w — wattage rating
elect. — electrolytic
v.d.c. — d.c. voltage rating

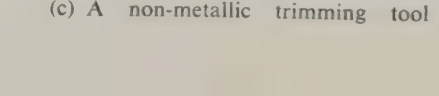
Circuit No.	Value	Description
C3	0.01mf ± 50% 20%	12 v.d.c. disc
C4	0.01mf ± „	„ „
C7	0.047mf ± 80% 20%	ceramic
C8	0.01mf ± 20%	150 v.d.c. m.tub.
C9	200pf ± 2½%	125 v.d.c. polystyrene
C10	0.02mf ± 20%	150 v.d.c. m.tub.
C11	0.47mf ± 80% 20%	ceramic
C12	200pf ± 2½%	125 v.d.c. polystyrene
C13	0.04mf ± 20%	150 v.d.c. m.tub.
C14	365pf ± 2½%	125 v.d.c. polystyrene
C15	4mf ± 100% 20%	15 v.d.c. elect.
C16	8mf ± 100% 20%	12 v.d.c. elect.
C17	0.1mf ± 50% 25%	3 v.d.c. disc
C18	200mf ± 2½%	125 v.d.c. polystyrene
C19	200pf ± 2½%	„ „
C20	200pf ± 2½%	„ „
C21	0.01mf ± 20%	150 v.d.c. m.tub.
C22	0.01mf ± 50% 20%	12 v.d.c. disc
C23	0.01mf ± „	„ „
C24	0.01mf ± 20%	150 v.d.c. m.tub.
C25	0.1mf ± 20%	150 v.d.c. m.tub.
C26	0.04mf ± 20%	150 v.d.c. m.tub.
C27	8mf ± 100% 20%	12 v.d.c. elect.
C28	100mf ± 100% 20%	10 v.d.c. elect.
C29	8mf ± 100% 20%	12 v.d.c. elect.
C30	100mf ± 100% 20%	6 v.d.c. elect.
C31	100mf ± „	„ „
C32	100mf ± 100% 20%	10 v.d.c. elect.
R1	56k ohm ± 10%	0.4 w
R2	680 ohm ± 10%	0.4 w
R3	1.8k ohm ± 10%	0.4 w
R4	47 ohm ± 10%	0.4 w
R5	1.0k ohm ± 10%	0.4 w
R6	33k ohm ± 10%	0.4 w
R7	6.8k ohm ± 10%	0.4 w
R8	1.5k ohm ± 10%	0.4 w
R9	120k ohm ± 10%	0.5 w
R10	680 ohm ± 10%	0.4 w
R11	150 ohm ± 10%	0.2 w
R12	2.2k ohm ± 10%	0.4 w
R13	680 ohm ± 10%	0.5 w
R14	18k ohm ± 10%	0.5 w
R15	22k ohm ± 10%	0.5 w
R16	4.7k ohm ± 10%	0.5 w
R17	1.0k ohm ± 10%	0.5 w
R19	680 ohm ± 10%	0.2 w
R20	2.2 ohm ± ½ ohm	0.4 w
R22	82k ohm ± 10%	0.4 w
R23	1.5k ohm ± 10%	0.4 w
R24	15k ohm ± 10%	0.4 w
R25	2.2k ohm ± 10%	0.4 w
R26	120 ohm ± 10%	0.4 w
R27	1.0k ohm ± 10%	0.4 w
R28	27k ohm ± 10%	0.4 w
R29	10k ohm ± 10%	0.2 w
R30	560 ohm ± 10%	0.5 w
R31	47 ohm ± 10%	0.4 w
R32	180 ohm ± 10%	0.4 w
R33	680 ohm ± 10%	0.4 w
R34	1.0k ohm ± 10%	0.5 w
R36	82 ohm ± 10%	0.5 w
R37	1.5 ohm ± 10%	0.5 w
TH1	90 ohm at 25°C ± 15 ohm	Termistor
RV1	5.0k	Log Law with switch
RV2	5.0k	Volume
RV3	2.0k ohm	Preset
VT1	2N1637	Transistor
VT2	2N1526	„
VT3	2N1524	„
VT4	2N1524	„
VT5	2N408	„
VT6	AC117	„
VT7	(AC117	Transistors supplied in
VT8	(AC117	matched pairs
MR1	OA79	Diode A.G.C. overloaded diode
MR2	OA90	Diode signal diode
T1	R.F. Transformer	
T2	Oscillator coil	
T3	1st & 2nd I.F. Transformer	
T4	1st and 2nd I.F. Transformer	
T5	3rd I.F. Transformer	
T6	Driver Transformer	
T7	Output Transformer	
L1, L2	Ferrite Rod Aerial, with coil	
CV1, CV2, CV3	3 Gang Variable Capacitor	
SK1	External Car Aerial Socket	
SK2	Battery Connector Socket	
PL1	Battery Connector Stud	
LS	25 ohms speaker	



CIRCUIT DIAGRAM FO

MURPHY MODEL P87

Olympic-Circuit and Service Data

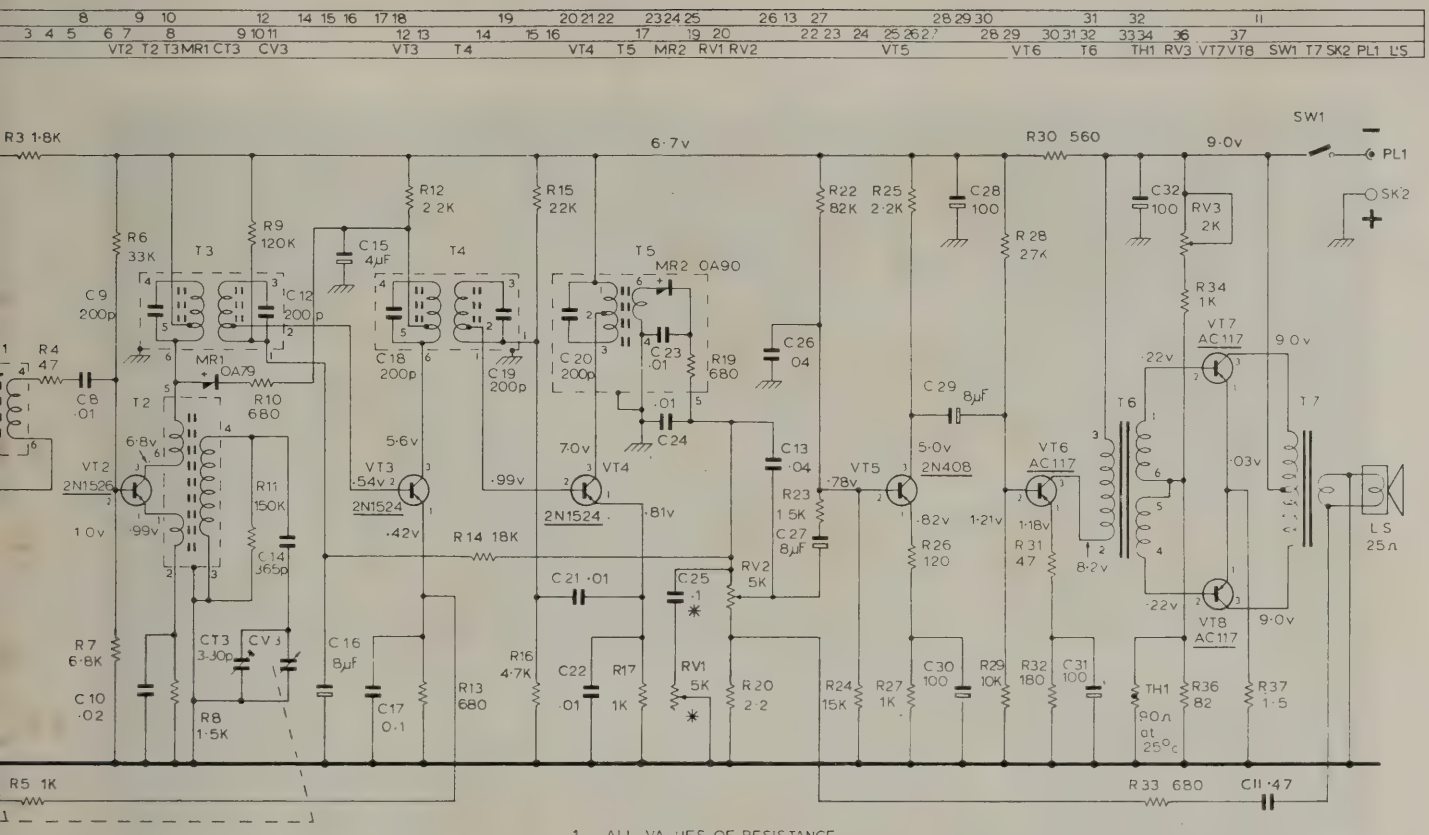


P87 ALIGNMENT INSTRUCTIONS

1. Equipment required.—
   (a) A signal generator to cover 450Kc/s to 1500Kc/s, modulated 30% at 400 or 1000 c.p.s.
   (b) An output wattmeter with a range of 0-2 Ow to match 25 ohm impedance.
   (c) A non-metallic trimming tool suitable for adjusting the and oscillator coil cores.
   (d) A 10pf capacitor for i signals into the car aerial and a 6.8k resistor for de ing the receiver during R.F ment.
2. The signal generator shou switched on at least 15 minu fore beginning alignment.
3. Set the receiver volume con maximum. During the alig the signal input should be a to maintain the output at each time a trimming adjustm made. The tone control sho set to maximum treble resp

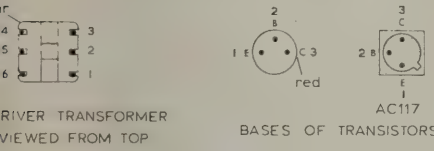
Audio Circuit

1. If the output pair of tra (AC117's) are replaced, re-adj quiescent battery current to under no signal and mi volume conditions, with RV3.



1. ALL VALUES OF RESISTANCE IN OHMS & ALL VALUES OF CAPACITANCE IN MICRO-FARADS UNLESS OTHERWISE STATED
2. VOLTAGES STATED ARE NEGATIVE WITH RESPECT TO CHASSIS & MEASURED WITH AVO NO 8 UNDER NO SIGNAL CONDITIONS & WITH VOLUME CONTROL SET TO ZERO.
3. ✱ OMITTED FROM MODEL PZ22

REFER TO PARTS LIST FOR PART NUMBERS AND COMPLETE DESCRIPTIONS OF ELECTRICAL COMPONENTS ORDER ALL REPLACEMENTS BY PART NUMBER AND LIST DESCRIPTION



URPHY MODEL **P87** TRANSISTOR RECEIVER

DRAWN	R	CHK'D		APPR'VD		used on P87
DATE	9.6.64	DATE	23-7-64	DATE	23-7-64	drg no. CP 4853
CIRCUIT DIAGRAM - P87 -						
ALLIED INDUSTRIES LIMITED AUCKLAND N.Z.						

2. Audio sensitivity should be better than 500mW for 20mV to the top of the volume control at 1.0Kc/s.
3. Audio output should be greater than 2.5 watts into 25 ohms.
4. At 1.0w output total current drain should be 300mA ± 20mA.

I.F. Alignment

1. Set signal generator to 455Kc/s and receiver to low frequency end of band. Inject the I.F. signal into the base of the converter.
2. Tune 3rd I.F.T. to peak nearest circuit board.
3. Tune primary and secondary of 2nd I.F.T. to outer peaks.
4. Screw the primary (lower) core of the 1st I.F.T. right out. Tune the secondary (upper) core to the outer peak and then peak the primary winding on the outer peak. **Do not** re-adjust secondary.

R.F. Alignment

Temporarily de-sensitise the receiver by connecting a 6.8k ohm resistor between the junction of R14 and C16 to chassis.

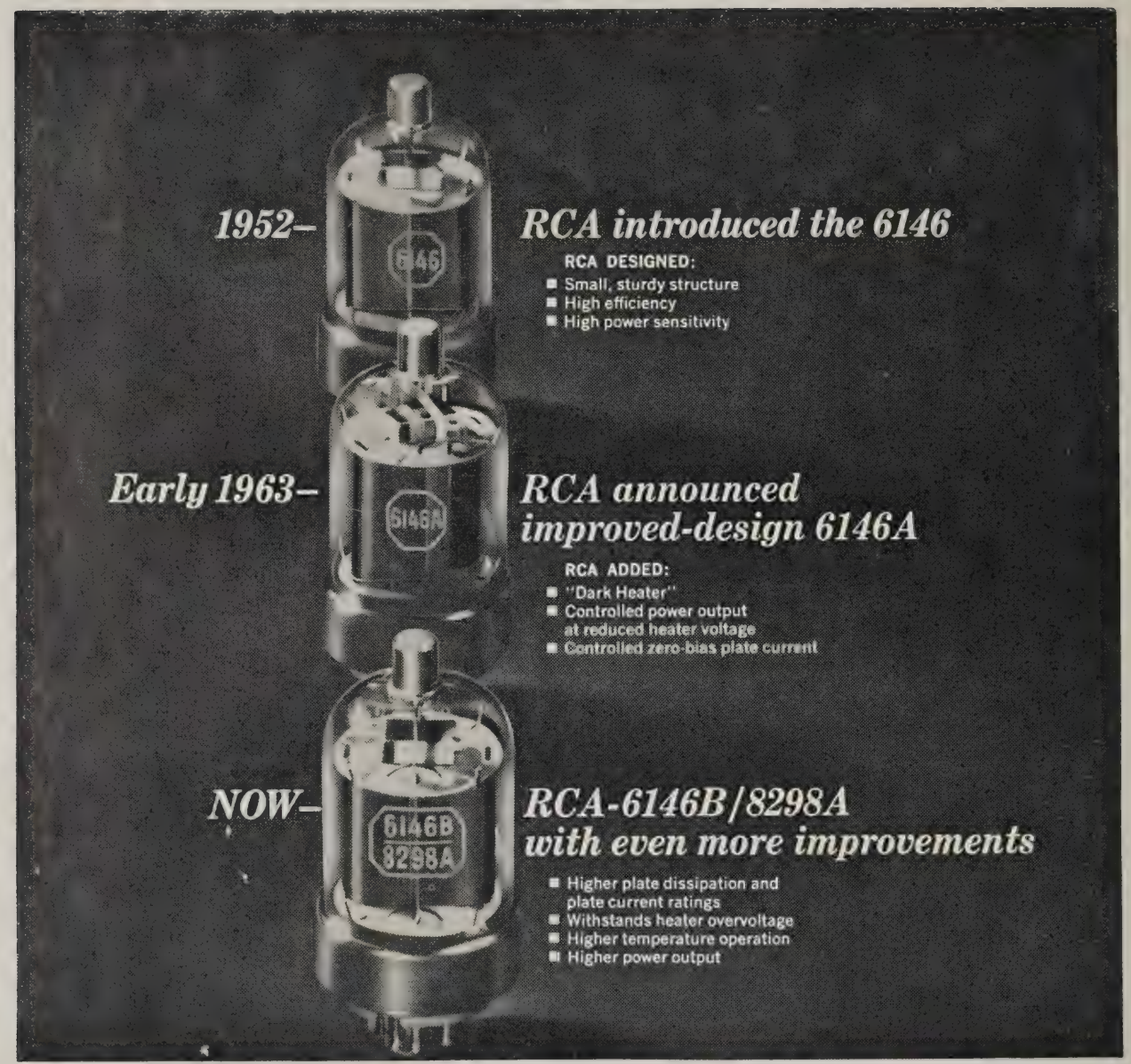
Connect signal generator via a 10pf capacitor to the ext. aerial socket.

1. Check that when the gang is fully meshed, the pointer lines up with the edge of the light track at the low frequency end of the scale.
2. Adjust the oscillator coil (T2) core at 600Kc/s and oscillator trimmer (CT3) at 1500Kc/s for max. response.
3. Adjust the R.F. transformer (T1) core at 600Kc/s and R.F. and aerial trimmers (CT2 and CT1) at 1500 Kc/s for max response.
4. The ferrite rod is unlikely to require adjustment, but, if necessary, the coils L1 and L2 should be moved along the ferrite rod for maximum output at 600Kc/s and then re-sealed with wax.

5. Check alignment at 1000Kc/s.

T1	R.F. Coil	1-2	0.6 ohms
		1-3	4.9 ohms
		4-6	0.5 ohms
T2	Osc. Coil	1-2	0.2 ohms
		3-4	3.3 ohms
		5-6	0.4 ohms
T3, T4	1st and 2nd I.F.	1-2	0.5 ohms
		1-3	9.0 ohms
		6-5	3.4 ohms
		6-4	9.0 ohms
T5	3rd I.F.	3-2	6.1 ohms
		3-1	9.6 ohms
		4-6	1.7 ohms
T6	Driver Transformer	2-3	160 ohms
		1-6	68 ohms
		4-5	68 ohms
T7	Output Transformer	Pri. each half	0.9 ohms
		Sec.	1.5 ohms

ENQUIRY CARD AD. 12



GET HIGHER POWER OUTPUT IN NEW EQUIPMENT DESIGNS

Now! Use and specify the RCA-6146B/8298A. This new RCA Beam Power Tube at once brings more power in new equipment designs and extended tube life in renewal use. In existing 6146, 6146A and 8298 sockets, RCA-6146B/8298A can give extended life while offering OEM designers increased power capability.

A direct result of RCA's power-tube research, the RCA-6146B/8298A permits higher plate dissipation (35 watts max. CW ICAS) for increased plate current. It also offers all the advantages of improved performance and mechanical stability that only RCA "Dark Heater" technology provides. At normal heater ratings, capabilities are: 85 watts CW output (ICAS) at 60 Mc; 50 watts CW output (ICAS) at 175 Mc.

GET EXTENDED LIFE WHEN REPLACING 6146, 6146A or 8298

In fixed station use, 6.3 volts is the recommended value for the tube's "Dark Heater." In mobile service, the tube operates efficiently over a range of heater voltages from 5 volts to 8 volts.

AMALGAMATED WIRELESS (AUSTRALASIA) N.Z. LTD.

2nd Floor, Commerce House, Wakefield Street, P.O. Box 830, WELLINGTON, Tel. 43-191.

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VR.24

SERVICEMAN'S COLUMN

Conducted by J. Whitley Stokes

Over the past few weeks Auckland lookers-in to AKTV2 have heard regular anouncements to the effect that viewers in some areas may be having trouble with interference from other stations. However as no details were given as to what the visible results of this interference would be, some viewers at least, were left in doubt as to whether a particular symptom which was apparent was in fact in the receiver.

I don't know whether the particular type of interference from a distant station on the same channel works both ways, that is whether Dunedin viewers suffer from interference from the Auckland station, but imagine it to be quite likely.

Fortunately anyway this state of affairs is quite short lived being due to atmospheric conditions which occur at this time of year. January in fact has become to be the month for TV. D.Xing and there are still those hardy souls to be found who will clamber on to the roof and swing their aerials around in an endeavour to receive Australian stations.

Anyway one result of the frequently repeated announcements of interference has been that some viewers who had actual faults in their receivers were left in doubt as I said earlier. Sometimes a set owner would put up with a defect for a week or so believing it to be due to interference when in fact the trouble was in his receiver. It was only after speaking to neighbours who were having no trouble that some owners came to wonder whether perhaps their receivers were in fact defective. One owner of a faulty set who rang the NZBC was told quite definitely not to worry as his trouble was undoubtedly due to this particular interference.

\+ + +

In view of the fact that many TV. aerials have been erected for over four years it is not surprising that they are beginning to show signs of deterioration. Apart from the obvious and outward signs of missing or broken elements it will often be found that considerable corrosion has taken place where the connecting screws are fitted. Fortunately there is a simple way to determine whether the connections to the lead-in are intact, that is where the aerial is of the folded dipole type, and this is to make a continuity test with a low range ohm-meter across the lead-in ribbon at the point where it is connected to the receiver. It is necessary to disconnect the lead from the set of course as not all models are fitted with isolating condensers. An elaboration of this simple continuity test was suggested by a colleague who conceived the idea of applying a low voltage high current source to the lead-in with the idea that the surge of current would quickly show up any weak spots as, for instance, where only one strand of the lead in wire was making contact with the connecting screw.

\+ + +

One of the first servicing jobs I ever carried out was on a battery set which used Philips Golden Series 2 volt valves, and due to nervousness or just plain carelessness I had the misfortune to blow out a complete set of valves. At the time a set of these valves was worth considerably more than a week's wages so I expected dismissal on the spot! However my miserable and apprehensive countenance must have softened the service manager's heart for I continued to occupy my place at the bench.

Since then I have come to realize that I wasn't the first serviceman to have such an experience nor would I be the last. In fact it wasn't so long after this episode that someone in the same firm dropped a bundle of ⅜" conduit on top of a radio with results which can be imagined. I found someone else's accident to be quite a morale booster and had plenty of time to ponder over it when I was given the job of repairing the damaged set. Over the years when any accident has occurred (and what serviceman hasn't broken at least one glass dial scale?) I am reminded of my first "radio accident".

With the advent of TV. there has always been the thought in the back of my mind that one day I might have an accident with a picture tube. Now there are those who believe that such negative thoughts may actually bring about the state of affairs envisaged and advise us instead to cultivate the right P.M.A. (positive mental attitude). Perhaps there is something in it —I don't know but I do know that eventually I had vacuum-less picture tube on my hands! It happened like this.

I had been working on a TV. set in a customer's home when suddenly there was a mighty hiss, as of escaping steam, which seemed to go on for several minutes but in reality was probably no more than 10 seconds. For a moment I didn't realize what had happened as I was working at the rear of the cabinet so didn't see the test pattern go off. There had been no sudden knock on the neck of the tube or any other obvious cause for its demise, yet it was as dead as a dodo. In fact it took a few minutes to find the cause of the bother. The particular set was one employing a swing down chassis hinged at the bottom and although I had lowered it into the "down" position quite gently I had not noticed that the lead to the tube socket had become twisted around a can type electrolytic condenser with the result that the lead was too short. This caused a downward strain on the tube base and had resulted in the exhaust tube, inside the keyed base spigot, being fractured, with a resultant loss of vacuum.

Fortunately the "lady of the house" was both an old customer and very understanding. She even went so far as to suggest that if the defunct picture tube was the result of any fault condition in the set, she would be prepared to pay for a new one. I assured her such was not the case and that I would have to provide her with a new picture tube at no charge. She was not to be outdone however for when I returned later

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HOW TO REPAIR COMMUNICATIONS RECEIVERS

by T. C. KING

From time to time special assignments become available which can be either very profitable or first class time wasters if not bad debts. Repair of communications receivers is usually in the first category provided that the circuit is understood and (mechanical or quartz crystal) filter circuits if used are undisturbed.

The first fault is usually distortion followed closely by loss of sensitivity. The output valve is flat and due for replacement because of two laws which operate simultaneously. First common factor is that shortwave listeners, hams, and D.X. listeners on broadcast, all appear to be stone deaf. They therefore run poorly baffled and consequently inefficient speakers (or mis-matched headphones) at inordinately high audio levels. Second, to minimise frequency shift during warm up, most communications receivers are left on stand-by or full-blast for hours at a stretch.

Often tapped mains input transformers are used. Frequently these are set to the 250 A.C. tap. This is wrong and the nearest 220-230 volt tap should be used. Cathode poisoning of the rectifier is a regular phenomena. It causes an unnatural drop in high tension voltage when weak signals are being tuned and the A.V.C. bias is minimal. The large number of valves in the better communications receivers frequently load rectifiers right up to rating. With a strong signal the stages controlled by AVC will draw very little current, the reduction can amount to 40 milli-amps. Always test voltages on weak signals with gain "flat-out"; leave the aerial off if necessary. If there is a big change when a strong signal is tuned, try another rectifier. If voltage fluctuates at an audio-rate with loud passages of music check the output valve and its associated input circuits.

A well designed communications receiver will avoid grid leak bias on the audio voltage amplifier as this circuit is inclined to rectify in the presence of transmitters located nearby thus causing feed through. The special circuits, including limiters with threshold bias net works, require understanding. It is best to refer to the Radiotron Designers Handbook which sets out the basic circuits and succinctly evaluates them. Incidentally the current models of Japanese communications-type receiver available in New Zealand have a number of limitations which are appreciated when the circuit diagram is cross-referenced with the Designers Handbook.

Working back into the receiver, the B.F.O. valve if weak will make it impossible to copy S.S.B. signals as the ratio of B.F.O. voltage to sideband should be at least ten to one. The tuning of the I.F. transformers should not be undertaken for routine servicing unless the slugs have been disturbed. Good I.F. transformers do not alter frequency as much as poorly executed re-alignment. The I.F. stages are the most important part of a good communications receiver and if left alone are the most reliable section. Do not substitute similar valves, the differences in A.C. plate resistance and bias threshold are important and will have been balanced for optimum results by the receiver's design team.

The frequency changing portion of a good receiver will operate smoothly over a frequency coverage that would seem impassible for an ordinary receiver. Triode heptode and triode hexodes will be used in receivers that many cover 550kc/s to 31Mc/s. The coil units are so designed that loading and coupling, together with fixed resistance damping, keep oscillator grid current reasonably constant for optimum operation. Some receivers use separate oscillators, usually those from American stables where heptode self excited converters are usual in ordinary receivers and the same valve type is pressed into service where it is less suitable. The circuits are usually so efficient that even a **very sick** valve will operate. As all signals must pass through the frequency changing stage, nine times out of ten loss of sensitivity is attributable to a weakened frequency changer valve. Not only is amplification lost, but low grid current causes low efficiency of conversion through inadequate injection. Bias's and operating points change with attendant faults in frequency drift and pulling. Cross modulation can become a problem too, where inadequate signal handling capacity remains. Always suspect an ECH35 where used as the triode section often drops away first.

The front end of the receiver may need a touch up in tuning, preferably on the actual aerial with which it will be used. I know of no satisfactory alternative procedure that works with N.Z. backyard aerials. My own receiver, the big expensive English one, will not perform satisfactorily on the top band without tuning the three R.F. stages while the aerial is connected.

A good work-over such as described here can be undertaken within half a day. It should not be rushed as clear thinking is required and replacement components for those "wounded in action" almost unobtainable. A signal generator covering the I.F. frequencies and a crystal calibrator at not less than 1Mc intervals are the only equipment needed. If the I.F. frequency is as marked no further use of the generator is necessary.

One can easily earn a high reputation as the owners of these sets have a lot of say about their hobby.

LISTENING POST

by michael lawrence

With the approach of winter, reception conditions can be expected to change gradually towards the middle of winter when, generally speaking, long distance reception should be best during our daylight hours and worse at night. To allow for these seasonal variations, most shortwave broadcasting organisations have issued frequency schedules to cover the autumn period from 7th March to 2nd May. Some schedules to hand for this March/April period are given below. Remember, all times are GMT which is 12 hours behind N.Z. time, and frequencies are given in kilocycles.

NEW ZEALAND — Little change has been made to Radio New Zealand's schedule which is:— To Pacific Islands: 1700-1945 hrs. on 9,540, 11,780; 2000-0545 on 15,280; 0600-0845 on 9,540, 11,780. To Australia: 2000-2230 hrs. on 11,780; 2245-0545, 15,110; 0900-1145 on 6,080, 9,540. To Antarctica on Sundays: 0815-0845 on 6,080.

CANADA — English transmissions from Radio Canada will be:— To Australasia: 0715-0850 hrs. on 9,625, 5,970. To The Forces: 1055-1214 hrs. on 17,820, 15,320, 5,970. To Europe and North America: 1215-1313 hrs. on 17,820, 15,320, 5,970. To Africa: 1833-1915 hrs. on 17,820, 15,320, 11,720. To Europe: 2045-2150 hrs. on 15,320, 11,720, 9,630. To Northern Canada: 0100-0230 hrs. on 11,720, 9,625, 5,970; 0555-0630 on 5,955; 0230-0700, 9,625, 5,970; 2200-2245 on 11,720, 9,625, 5,970; To Caribbean and Latin America: 2300-2330 hrs. on 15,190, 11,760, 9,625.

GERMANY — English transmissions from Deutsche Welle:— To Australasia: 0845-0940 hrs. on 9,640, 11,925, 15,275; 2110-2200 hrs. on 5,980, 7,175. To South Asia: 0730-0840 hrs. on 11,785, 15,275, 17,845; 1550-1620 hrs. on 9,545, 11,775. To Africa: 0605-0635 hrs. on 11,785, 15,275, 17,845; 1615-1710 hrs. on 11,890, 15,275, 17,845; 2020-2050 hrs. on 9,575, 11,785. To North America: 0135-0215 hrs. on 6,175, 9,640; 0455-0535 hrs. on 6,145, 5,960, 9,575, 9,735; 1510-1550 hrs. on 9,735, 11,795, 11,885.

GREAT BRITAIN — As all the BBC transmissions in the General Overseas Service can occupy considerable space, only those beamed to Australia and New Zealand are given here:— 0600-0800 hrs. on 6,110, 7,150, 9,510, 9,640, 11,955; 8000-0845 hrs. on 7,150, 9,640, 11,955 (Pacific Service); 0915-1130 hrs. on 15,435, 11,750 (Singapore Relay); 0915-1115 hrs. on 9,725 (Singapore Relay); 2000-2230 hrs. on 11,820.

An interesting feature of the latest schedule is the BBC's intention to use higher powers on some frequencies. Examples of this are 250kW in place of 100kW on 15,435 and 250kW instead of 75kW on 9,640 and 7,150.

AFGHANISTAN — The full schedule of Radio Kabul is given here:— English to Far East: 1030-1100 hrs. on 15,225. English to South Asia: 1100-1130 hrs. on 15,125. English to Near East: 1500-1530 hrs. on 4,775. Russian: 1730-1800 hrs. on 4,775. German: 1830-1900 hrs. on 9,635. French: 1900-1930 hrs. on 9,635. Arabic: 0300-0330 hrs. on 11,965.

News from Here, There and Everywhere

INDIA. Reception of All India Radio is very good on the two frequencies (11,710 and 15,165) beamed towards N.Z. between 1000 and 1100 GMT. A ten minute news bulletin is broadcast at 1000 GMT. However, the South East Asia service at 1330 is not so well received on either of its frequencies of 15,225 and 11,810 kc/s. English news in this transmission is at 1330.

DENMARK. The Voice of Denmark is changing the frequency of the N.Z. transmissions on Tuesdays, Thursdays and Saturdays from 15,165 to 9,520. This will come into effect on the 7th March. Times for the transmission are 0900-1000 with the first half hour in Danish and the last half hour in English. A DX bulletin is broadcast in the last five minutes or so of the Thursday transmission preceded by a fifteen minute programme for those wishing to learn Danish.

FRANCE. The English language section in the Far East Service of Radiodiffusion-Television Francaise can provide interesting listening for the late nighter. Operating from 1300-1400 GMT the transmission can be heard on the following frequencies: 11,850, 17,720, 15,245, 21,580 (beamed to Africa) and 21,500kc/s. The 15,245kc/s outlet provides good reception in N.Z. The first half of the transmission is in English consisting of a ten minute news bulletin presented in an informal manner followed by "an insight into French life" and the second half, from 1330-1400 GMT is in French.

Solar Eclipse in the Pacific

The solar eclipse in the Pacific on May 30th, between approximately 2000 and 2300 GMT, could provide some interesting information regarding radio propagation and David D. Meisel of 5633 Selby Court, Worthington, Ohio, 43085 U.S.A. who, as a professional astronomer, led an expedition to Moose River, Ontario, for the July 20th, 1963 solar eclipse, has appealed to shortwave listeners, amateurs and radio clubs to conduct monitoring experiments during this year's eclipse. He suggests that listeners monitor shortwave stations, which are normally received well, whose transmissions come out of or across the eclipse area.

The eclipse area will be in the following positions on May 30th:—

GMT	LATITUDE	LONGITUDE
1943	S 33° 42'	E 176° 40'
2000	2 20° 57'	W 161° 22'
2100	S 04° 14'	W 139° 15'
2200	N 00° 52'	W 120° 50'
2252	S 07° 41'	W 83° 26'

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Science Congress held in Auckland

At the time of going to press the 11th New Zealand Science Congress had just concluded in Auckland.

Two sections of the Congress, Section A: Physics, Mathematics and Space Science; and Section H: Architecture and Engineering dealt in depth with many communication and electronic subjects and it is hoped that some of the more important papers presented will be published in "Radio Electronics and Communications" in the next few issues. Our Editors were present at many papers and were greatly impressed by the work being carried out in this country in the many fields under discussion.

Below we give brief details of some of the papers presented.

NUCLEAR PHYSICS AT THE UNIVERSITY OF AUCKLAND

Professor D. Brown, University of Auckland

The experimental facilities at present available or under construction were discussed in relation to the programme of research in the Physics department. There has previously been an emphasis on two-stage or double-scattering nuclear experiments, attributable to a particular interest in studying nuclear polarization or spin-dependent effects. These are important for a full understanding of nuclear forces which are spin-dependent, but the experiments are difficult and require special techniques. A spin-flip solenoid for neutrons and a helium-3 tensor polarimeter for deuterons was described. The advantages of the new techniques for polarising the particles, protons or deuterons, prior to their being accelerated in the accelerator was discussed, and the steps that are being taken to incorporate this feature in a small and a large Van de Graaff accelerator now under construction in the department were explained.

ATOMIC FREQUENCY STANDARDS

V. B. Gerard, Physics and Engineering Laboratory, DSIR,, Lower Hutt

Atomic frequency standards can be classed as active or passive atomic resonators. The active devices are masers which provide a signal consisting of stimulated emission of microwave energy. The ammonia and atomic hydrogen masers are examples.

Passive atomic resonators provide an absorption line which is used to set a quartz crystal oscillator, either manually or by servo. Caesium atomic beams and optical absorption gas cells using the alkali metals are examples. Some work has been done in New Zealand on the optically pumped rubidium gas cell device.

ENGINEERING RESEARCH AND DEVELOPMENT IN NEW ZEALAND

J. B. Brooke, Industrial Development Division, DSIR, Auckland

This paper described the place of Engineering Research and development must be strengthened, and it is vitally importbeing done, how well it is being done, and where more could be done. Although historically New Zealand has been an agricultural and pastoral country, the development of a sound engineering industry is essential to the country's economic welfare.

Science has played a large part in bringing the agricultural and pastoral industries to their present stage of prosperity, and has covered a broad spectrum from basic research right through to scientific services that bring the results of research down to the individual farmer.

If New Zealand's growing manufacturing industry is to achieve a comparable level of efficiency, industrial research and development must be strengthened, and it is vitally important that the results of this work must also be carried over to the individual manufacturer, in terms that he can understand and use.

ELECTRICAL AND MECHANICAL MEASUREMENTS IN AGRICULTURE

D. S. M. Phillips, Ruakura Animal Research Station (Presented by G. M. Nichols)

The application of physical measuring techniques to agricultural research can allow the measurement of variables under adverse conditions with an ease and accuracy which makes data collection over extended periods a relatively simple matter.

This paper described several applications of these techniques, particularly in the field of milk secretion research in which the author is actively engaged.

1. Electro-mechanical milk weighing and recording equipment.
2. Electronic measurement of the intramammary pressure in the cow.
3. High speed recording of milk flow rates over short periods.
4. A simple hydraulic weighing machine for weighing livestock.
5. A simple mechanical pasture yield comparator.

ELECTRONICS IN AGRICULTURE

G. de la M. Nichols, Ruakura Agriculttural Research Centre

Radio-frequency measurements of growing grass, death rate of grass and liveweight of sheep, Telemetry and radio-frequency bridge methods were the subject of this paper.—

Problems of electro-ejaculation of rams, bulls and mice with reference to fertility and artificial insemination.

Telemetry from grazing animals. Heart rate of sheep when shorn in mid-winter.

The low impedance electric fence and the fish fence.

Pre-swarm detection of honey using the Apidicator.

APPLIED PHYSICS, i.e. ENGINEERING

S. Lattimore, Physics and Engineering Laboratory, Lower Hutt

Since the last war, the number of physicists employed in industry of all types, has increased at a great rate. The work being carried out includes basic and applied research, and development, as well as servicing facilities. This lecture described some of the work which may fairly be called applied physics, and investigations into the mechanisms of machine tool chatter; the development of numerically controlled machine tools; the characteristics and applications of fluid amplifiers and logical elements; and new methods of forming and machining metals.

EXPLODING WIRES AND FOILS AS DETONATORS

J. A. Phillips, Victoria University of Wellington

An account was given of experiments performed by the author on the use of exploding wires and foils to initiate the detonation of PETN and other explosives. A charged capacitor is used to explode the wire or foil. Oscilloscope recordings of the variation of discharge current with time have been obtained for wires and foils surrounded by explosive and in air. The minimum energies required to initiate the detonation of several explosives by means of a wire explosion have been measured. Various practical applications are considered including explosive forming and the production of shaped detonation waves.

SOME APPLICATIONS OF DIGITAL ELECTRONICS IN INDUSTRY AND SCIENCE

W. P. Gabriel, Physics and Engineering Laboratory, Lower Hutt

Electronic work at the Physics and Engineering Laboratory, DSIR, Lower Hutt, features an increasing use of digital techniques. Such techniques lead to equipment with

a high degree of versatility and reliability. Two digital applications:— The use of predetermined counters for aerial and elapsed time photography, and the programming of set points in temperature and humidity control, were dealt with.

RECENT PROGRESS IN RESEARCH INTO THE RADIO AURORA

R. S. Unwin, J. G. Keys and D. Brooks
Physics and Engineering Laboratory Auroral Station, Lauder

The radio aurora is produced by field-aligned ionization in the E region occurring in the vicinity of the auroral zones during magnetic disturbance. There are wide variations in its appearance, magnetic relationships and movement. In the early morning it is undoubtedly closely associated with ionospheric electric currents, but the relationship is less clear at other times. The association between radio aurora, optical emissions, magnetic variations and radio absorption is under study. Pulsations in the radio aurora frequently occur, and are believed to be produced by hydromagnetic waves excited in the outer region of the magnetosphere by the solar wind.

VERY LOW FREQUENCY PROPAGATION — A REVIEW OF RECENT NEW ZEALAND WORK

G. J. Burtt and F. A. McNeill
Physics and Engineering Laboratory, DSIR, Lower Hutt

Reasons for the resurgence of interest in this type of radio transmission were given, together with an account of the investigations that are being carried out ,and some of the problems that have shown up, particularly on transmissions over long paths (over 5,000 Kms).

PREFERRED PATHS FOR PROPAGATION OF V.L.F. RADIO WAVES THROUGH THE MAGNETOSPHERE

G. McK. Allcock
Physics and Engineering Laboratory, DSIR, Lower Hutt

Radio waves from V.L.F. transmitters can travel through the magnetosphere along lines of force of the earth's magnetic field, in the so-called "whistler mode", to the magnetic conjugate point.

What happens in the common practical case where the receiver is remote for the conjugate point? An approximate theory suggests that there are two paths with least attenuation: (1) under the ionosphere from the transmitter to the receiver's conjugate point, then along a magnetospheric path to the receiver; and (2) along a magnetosphere path from the transmitter to its conjugate point, then under the ionosphere to the receiver. Experimental results give general support to this idea.

SCATTERING EFFECTS IN LONG-DISTANCE RADIO PROPAGATION

H. A. Whale, R. W. Bannister and I. R. Edmonds
Radio Research Centre, University of Auckland.

Some effects of ionospheric and ground scattering on the propagation of radio waves over very great distances were reviewed briefly. Specific relevant investigations discussed included:

- the size and shape of the antipodal area
- the diurnal variation of elevation angle of an incoming wave
- the diurnal variation of the ratio of scattered to specular modes
- the direct study of small irregularities using scintillations of satellite transmissions.

MEASURING THE ATMOSPHERIC ELECTRIC FIELD IN AUCKLAND

K. Kreielsheimer, M. D. Johns and R. L. Drinkrow
University of Auckland

This paper summarises recent work done at Auckland University in the field of Atmospheric Electricity. A brief introduction (Kreielsheimer) was followed by a description of the measuring techniques and apparatus used (Johns) and a discussion of the results obtained (Drinkrow).

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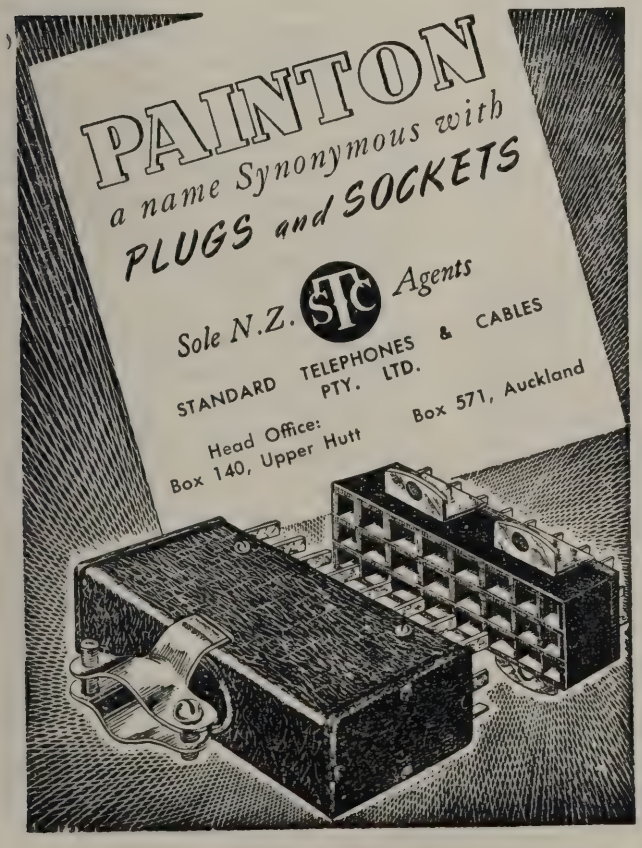
ENQUIRY CARD AD. 13



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LOOKING AT

MAGNETIC CORE MEMORIES*

One of the most common types of digital computer memory system is that which uses tiny rings or toroids of ferro-magnetic material. By changes in their magnetic state, these rings can "store" data. Whilst it is beyond the scope of this article to fully describe all systems of magnetic core storage, some basic information can be given which may prove an aid in understanding the operation of data processing systems which use magnetic cores.

The important factor in the preamble above, is the word "store". Storage can best be defined by saying it is somewhat like a filing cabinet, completely indexed, allowing almost instantaneous selection of data. There are two main storage categories, these being called main and auxiliary storage facilities.

The main storage which is generally located within the central processing unit can accept data directly from an input system such as a card or tape reader, or type writer; supply instructions to the central processing unit and furnish data to an output unit such as a card punch or type writer. To date, main storage memories consist of magnetic drums, magnetic thin films, of which more will be said in a later article and magnetic cores which is the subject of this article.

Examples of auxiliary storage are magnetic tapes and punch card systems. This type of storage is necessary to augment the capacity of the main storage system.

Since all data to be processed by any system must pass through the main storage, this memory must have the capacity to retain a usable amount of data, plus the necessary instructions for processing it. Additionally, because so many references must be made to this unit, the speed of access to its information content has a direct bearing on the efficiency of the entire data processing system.

The Speed of a Magnetic Core Memory

Normally, when the speed of a magnetic core memory is mentioned, it usually relates to either access or cycle time.

In core memories, storage is arranged somewhat like a group of stacked, numbered boxes, with each box holding a specific unit of data. This may be a character, a digit, a complete record or a word. To insert or remove a specific piece of data, the correct box, which is referred to as an "adress" is selected.

When new information is placed in an "adress", it replaces the previous contents of that "adress". However, when information is taken from the "adress", the contents remain unaltered. Thus once located in storage, the same data can be used repeatedly.

Basically, it is the time the system requires to locate and transfer this data to or from storage that determines the speed of the memory unit.

When the term "cycle-time" is used, it refers to the time it takes to select a bit (one storage location), remove the data, and be ready to select it again. In practice, the system might move on to another storage location before the contents of the previous location were returned to their original position. This would be "access-time" — the time it takes to select a bit.

Of the two figures, cycle-time probably is the more important, when referring to the more advanced core memories which may have typical access times of 0.5 to 0.6 microseconds and cycle-times of 0.7 microseconds or more.

Magnetic Core Storage

A magnetic core is a tiny ring of ferro-magnetic material the smallest of which, developed to date, is about 21 thousanths of an inch in diameter. Each core is pressed out of a mixture of ferric-oxide powder and other cement materials and then baked and anealed in a furnace.

One of the most important features of this type of core, apart from its size, is its ability to achieve a state of total magnetism within a few microseconds or less. And, unless deliberately altered, it retains this magnetism almost indefinitely.

In use, the core — actually a number of cores — are strung on a wire, and a current pulse is sent through the wire. The direction in which the current flows determines the polarity or magnetic state of the core as shown in Fig. 1. This means that a core can represent either of 2 distinct states or conditions. These can represent 0 or 1; yes or no; plus or minus; on or off but in any case the difference in condition between cores is the basis for storing most information.

In many of the large computers, up to 1 million cores may be used. Smaller computers may only use 10 to 20 thousand cores. In these smaller systems, the storage capacity is normally increased through the addition of auxiliary memory or storage units.

Since any specified location of storage must be instantly accessible, these cores strung on a wire are further arranged so that any combination of ones and zeros representing a character such as the letter A — can be written magnetically and "read" back when needed. To accomplish this selection another wire is strung through each core, crossing at a right angle to the original wire as shown in Fig. 2. By sending half the current required to magnetize a core through each wire, only the core surrounding the intersection of the wires is magnetised; whilst no other core in the string is affected.

* This article is based on material published in "Electronics World" April 1964 which source we gratefully acknowledge.

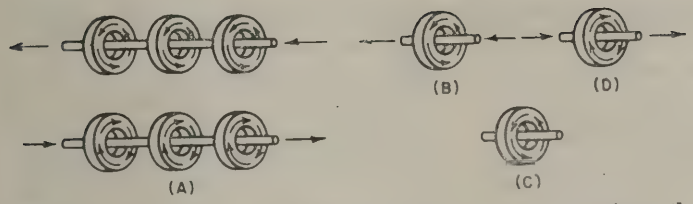

FIG. 1 — (A) The direction of current flow determines the magnetic state of the core. (B) Magnetic field when current is applied. (C) When current is removed core remains magnetised. (D) When current is reversed, core reverses magnetic state.

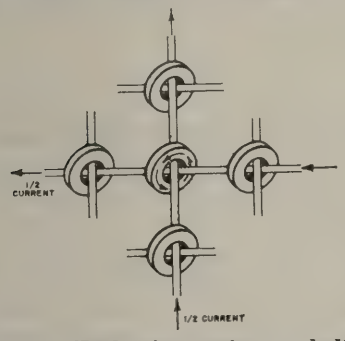

FIG. 2 — Each wire carries one half the current needed to magnetise a core and only the core at the intersection gets enough current to fully magnetise it.

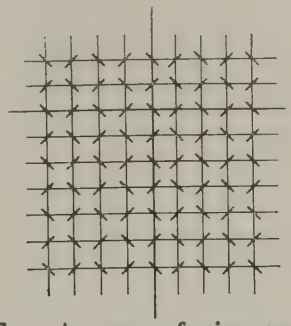

FIG. 3 — An array of wires and cores is called a plane. Any core can be selected by passing current down a pair of wires.

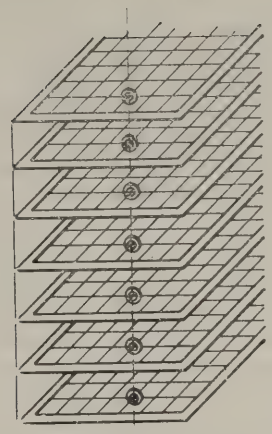

FIG. 4 — In this seven plane core memory, all cores representing a particular alpha-numeric character are stacked one above the other and are magnetised to represent only that particular character

With this principle, numerous cores can be strung on a screen of wires, yet any given core can be selected either for storage or read-out, without affecting any other. Such an array of wires and cores is called a plane, and is shown in Fig. 3.

Actually it takes more than 1 core to represent an alphabetical character. To illustrate this, assume the letter "A" is to be placed in storage. Using the binary coding decimal system, which is written as BCD system, the one most frequently used in computer systems, seven planes such as those shown in Fig. 4 will be required. One core in each of these planes is magnetised positively or negatively, the seven cores thus representing the configuration of the letter. In this case the letter "A" will be represented by the numbers 1110001.

Note that the planes in the memory unit are stacked one on top of the other, with all cores representing "A" appearing at the intersection of the same two wires (i.e. position on the plane). If an imaginary line is drawn vertically through these cores, it would show the physical location of one character of storage.

Once this information is placed in core storage, some means must be devised to make it accessible; that is, to recall it when it is needed. While it was mentioned previously that a definite magnetic polarity could be achieved in a core by passing a current pulse through its centre, in fact, this pulse causes the core to change its state from a positive to a negative polarity, or vice versa depending on the direction of the pulse. When this change in magnetic state occurs, a current pulse is induced in a third wire which also passes through the centre of the core, as shown in Fig. 5A. This signal indicates that the core contained a "1". If no output pulse was produced, the core contained a "0". Unlike the other wires in the plane, only one sense wire is required for the entire plane, since only one core at a time is interrogated. In this case "read out" is destructive, because the core has changed its state. To retain the originally stored data, then, the computer must replace a "1" in those cores that previously contained "1" while at the same time, allowing those cores that contained "0" to remain as "0".

To achieve this, the computer, in effect, writes 1 in all the cores which prevoiusly were "1", while suppressing the writing in cores, through the use of an inhibit pulse, flows through a fourth wire, which like the sense wire, runs through every core in the plane as shown in Fig. 5C.

This generally is how a memory unit of a magnetic core operates. Recently, techniques have been developed which allow the production of sub-microsecond type

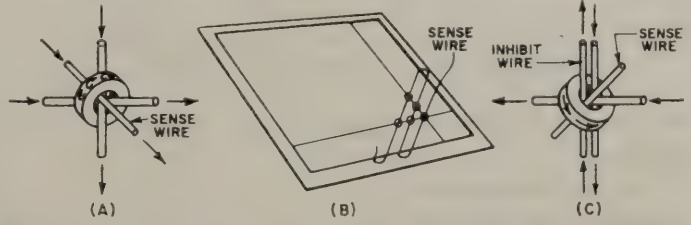

FIG. 5 — (A) When a core is made to change state, a pulse is picked up by the sense wire. (B) This sense wire is threaded through each wire in the plane. (C) The inhibit wire passes through every core in the plane and is used to enable the cores to be reset to their original state so that the memory is not altered.

cores. Also the means of locating information has been improved. In conventional core storage, the selection of a character is made by a co-ordinate selection system in which 2 choices must be made. In the new style memories, only one choice is made, and only the cores selected receive the switching current. This has resulted in the achievement of sub-microsecond access and cycle-time speed in the interrogation of cores.

Partial core-switching is also being used. In the case of the memory we have described, the cores are completely switched. In the new style memory circuits, the cores never change magnetic polarity, only the intensity of magnetisation is altered. As a result both the switching time and energy requirements are greatly reduced.

\+ + +

Australian Team Measures Hot Stars

By combining techniques from radiophysics, interferometry and electronics, an Australian team of scientists led by Prof. Hanbury Brown, formerly of Jodrell Bank, are now able, for the first time, to measure the actual size and temperature of hot bright stars far smaller than the six stars measured with the Mount Wilson optical telescopes in the 1920s.

The new equipment, designed by Prof. Hanbury Brown and Dr. Richard Twiss, was built at Sheffield and is installed at Narrabri, 350 miles north of Sydney under a joint project of the Universities of Sydney and Manchester, financed by the DSIR and the US Air Force.

The equipment, which can measure angles of one-thousandth of a second of arc, consists of two mirrors, each of 22ft. in diameter, which collect light from the star. They focus the light on to a photo-electric detector, where it is converted into electrical signals.

The fluctuations of the star's light appear in the signals and these are compared with an electronic correlator.

When the mirrors are close together, the fluctuations in the two signals are identical, but as the mirrors move apart each sees a different part of the star at a different distance.

To determine the diameter of the star, the correlator measures the similarity between the fluctuations in the mirrors as they are moved apart. When the correlator is at zero, the distance apart of the mirrors provides information for determining the star's diameter.

\+ + +

The Old Links will serve Science

The first trans-Pacific telegraph cable was opened 62 years ago in December, 1902. Since then other cables have slowly sunk to the great depths of the Pacific Ocean, routed via Faning Island. Now COMPAC has rendered these old armour-sheathed telegraph cables obsolete for traffic.

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ENQUIRY CARD AD. 20

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1 only	Decade Resistance Box Model DR-1U Daystrom	£13	18 0
1 only	Decade Capacitance Box Model DC-1 Daystrom	£9	17 0

Also approximately £100 worth of transistors and small component parts.

All the equipment is for sale at the actual U.K. purchase price as the research programme for which it was required has been cancelled.

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CHRISTCHURCH

the 'oscar' 2 metre translator

In the July 1963 issue of this journal at the conclusion of an article entitled "Looking at Oscar" we discussed the development of an Orbiting Satellite V.H.F. Translator capable of relaying signals on the 2 metre International Amateur allocation. Here is the latest news.

"Oscar 3" is a free access "repeater" that is expected to remain in orbit for about 1 month. The "Project Oscar" Association hopes that orbital altitude will be of the order of 500 miles or more, and that the satellite will be launched in a south-easterly direction from California.

The repeater will accept amateur signals of any mode lying in the region of 144.075 to 144.125 Mc/s, instantly translating and re-radiating signals in the region 145.875 to 145.925Mc/s. The frequencies are inverted in the translation process, about the centre frequency of 144.1 and 145.9Mc/s. Thus a signal entering "Oscar 3", on 144.080Mc/s will be retransmitted on 145.920Mc/s. The use of C.W. or S.S.B. is recommended for best signal/noise ratio.

It is recommended that stations wishing to communicate via "Oscar 3" form into teams and institute pre-arranged schedules and times for calling and listening. The duration "Oscar 3" will be in view of any two V.H.F. stations will be a matter of minutes on each pass, and co-ordinated action between serious participants is urged. There will be two or three passes every 12 hours which could probably be within range but accurate logging and time-keeping will be necessary. The "Project Oscar" Association urges that the translator output passband be continually monitored, preferably using a tape recorder to log all frequency translated signals.

If a nearly circular orbit is achieved, the height of Oscar 3 may be determined as below.

Period	Minutes	Height
,,	88	100 miles
,,	91	200 miles
,,	94	300 miles
,,	97	400 miles
,,	100	500 miles
,,	103	600 miles

The approximate horizon range of the satellite can be determined from the next set of tables.

Height	Slate Range to Horizon
100 miles	900 miles
200 miles	1300 miles
300 miles	1700 miles
400 miles	1900 miles
500 miles	2200 miles
600 miles	2300 miles

Operational range will tend to be less than this depending on the terrain surrounding the ground station.

The "Oscar 3" satellite has completed all tests and has been delivered to the launching agency. Whilst the exact date of launch will not be known, it is hoped that "Oscar 3" may be launched during March 1965.

Project Oscar Information broadcasts, will commence from W6EE, the Oscar Tracking and Communications Headquarters at Foothill College, Los Altos Hills, California, U.S.A., in early March.

The following frequencies will be used.

S.S.B. 3810Kc/s, 7205Kc/s, 14300 Kc/s.

C.W. 3507.5Kc/s, 7015Kc/s, 14030 Kc/s.

R.T.T.Y. 3620Kc/s, 7040Kc/s 14080Kc/s.

Generally speaking S.S.B. production broadcasts will start on the hour, followed by the C.W. broadcasts at 15 minutes past the hour, with the R.T.T.Y. broadcasts commencing on the half hour. It is hoped that W6EE will be on the air from 1600 GMT to 0500 GMT. During the first few days of orbit W6EE probably will be on the air "around the clock".

Oscar 3 Orbital Predictions

"Oscar 3" orbital predictions will be generated by Project Oscar Headquarters and these should be considered the only "official" predictions. The predictions will be broadcast by W6EE using **3 different messages.** One message will concern North America, a second will concern Europe, and a third message will concern Australasia. Each message will contain the basic orbital parameters, followed by groups of predictions concerning 3 or more days. Each message will be dated and numbered, and will contain the orbit number, the time (GMT) of equatorial crossings for that orbit, and the west longitude at which "Oscar 3" crosses the equator. In addition, in many cases, a reference crossing over a particular city will be given. For North America, whenever "Oscar 3" crosses the 40th parallel, crossing time for a reference City in the U.S.A. will be specified. Time of crossing for reference cities on the 50th parallel will be given for European observers, and time of crossing for reference cities on the 32nd parallel (south) will be given for Australia and N.Z.

Telemetry Calibration and Tracing Beacon

In addition to the translator, Oscar 3 will be carrying two low power beacons. One, operating on 145.950Mc/s will be a continuous carrier for tracking purposes. The other, transmitting on 145.850 Mc/s will transmit "HI's" and bursts of telemetry. The two HI identification signals are transmitted in morse code followed by 2 successive transmissions of telemetry. The first telemetry signal (T1) indicates the temperature of the transistors in the linear amplifier of the translator. The second telemetry signal (T2) is indicative of the temperature of the battery case which is the largest mass in the satellite.

Battery voltage is indicated by the Pulse rate of the telemetry. This can be determined by the aid of a stop watch. Count the time required for one complete telemetry cycle (2 HI's. plus two telemetry bursts) and divide the time by 512 to obtain the pulse rate. This can be converted to battery voltage using the following chart.

Pulse rate C.P.S.	Battery voltage
65	20 volts
60	18 volts
55	16 volts
50	14 volts
45	12 volts
40	10 volts

ENQUIRY CARD AD. 15

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:6.3v C.T. @ 5A.
Choke:—C42. Use 400v P.I.V. Diodes.

R104 Stereo Power Transformer. 10w

320v @ 320mA. Voltage doubler Rect.
230:130v @ 320mA.
:6.3v @ 6A.
Choke:—C49. Use 500v P.I.V. Diodes.

R105 T.V. Power Transformer For Philips T.V. Kitsets

220v @ 420mA D.C. Voltage Doubler Rect.
230:106v @ 420mA D.C.
:6.3v @ 10A.
:0—6.3—7.5—9 Ov @ 0.3A. Picture tube Winding.
Choke:—C45. Use 400v P.I.V. Diodes.

R106 T.V. Power Transformer for Philips T.V. Kitsets

This type similar to R105 but less Picture Tube boost taps. Main Fils. 12.6v C.T. @ 5A.
220v @ 420mA D.C. Voltage Doubler Rect.
230:106v @ 420mA D.C.
:12.6v C.T. @ 5A (2 windings 6.30v @ 5A each).
:6.3v @ .3A Picture tube winding.
Choke:—C45. Use 400v P.I.V. Diodes.

R108 Small Stereo Headphone Power Transformer

250v @ 22mA D.C.
230:110v @ 22mA D.C. Voltage doubler Rect.
:6.3 @ 0.86A.
Choke:—C41. Use 400v P.I.V. Diodes.

R110 T.V. Power Transformer. For Philips T.V. Kitsets

This transformer uses full wave bridge rectifier. Requires no limiting resistor unlike equivalent voltage double types, also has advantage of no insulated capacitor and lower ripple output with smaller choke.
Output 220v @ 420mA D.C.
230:172v @ 420mA D.C. Full wave bridge Rect:
:12.6v C.T. @ 5A (2 only 6.3v winding @ 5A).
:6.3v @ .3A Picture tube winding.
Choke:—C50. Use 400v P.I.V. Diodes.

R111 T.V. Power Transformer

Similar to R110 but for R.C.A. type Kitsets.
260v @ 350mA from Rect.
230:207v @ 350mA D.C. Full wave bridge Rect.
:12.6v C.T. @ 5A (2 only 6.3v windings each 5A).
:6.3v @ 0.6A. Picture tube winding.
Choke:—C42. Use 400v P.I.V. Diodes.

R112 Oscilloscope Power Transformer

R.T.V. & H. 1963. Calibrated.
230:110v @ 80mA D.C. Full wave voltage doubler.
:6.3v @ 2.4A.
:6.3v @ 1A.
:6.3v @ 1A.
Use 400v P.I.V. Diodes.

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Mystery of the aerials for ascension . . .

An announcement by British Insulated Calenders Construction Co. of a £90,000 order from the Marconi Co. for new radio masts for Ascension Island does little to dispel some of the elements of mystery which appear to surround the setting up of a major broadcasting and communications base on this lonely Atlantic island off the coast of Africa.

It was officially announced in January, 1962, that the government had approved a programme of building new stations for the BBC external services in both the UK and overseas.

In March, 1963, it became known that these plans included a major relay station to be set up on Ascension at a cost of £1.5m, and this project is briefly referred to in the latest BBC Annual Report.

Four of the powerful BD272 250kW HF broadcast transmitters for Ascension were ordered by the BBC from Marconi many months ago, according to the company's journal "Sound & Vision Broadcasting".

Start in Summer

The BICC order is for one 250 foot and eight 325 foot masts, constructed of steel lattice angle sections, and design of the foundations. Work on the erection of these masts will start this summer. No confirmation can be obtained as to whether or not these masts are for the BBC stations.

Behind these known facts of the Ascension station, there are unofficial rumours of a dispute between the BBC and various government departments over the control of such overseas broadcasting facilities and there is some speculation that these departments are anxious to play a more important role in external broadcasting.

It is possibly significant that there have been advertisements by a government department for engineer-technicians to operate and maintain high power broadcasting stations with "strong liability for overseas service".

In the period which followed the 1956 Suez crisis it was widely believed that the government of the day resented the stand taken by the BBC in providing impartial news bulletins during the crisis.

A number of other countries, including Germany and the United States are establishing major broadcasting facilities in Africa.

Mountain op Sites

The urgent need for the Ascension station in order to improve British broadcasting not only to Africa but also to South America is underlined by the recent statement in "Electronics" that on 15Mc/s Radio Moscow puts into Latin America an 8-14dB louder signal than the BBC, with Radio Peking some 10-15dB louder than Radio Moscow.

Among the suggestions put forward to account for these wide differences are the use of very much higher power, transmitters sited on mountain tops to provide low angles of radiation, and the possible use of backscatter techniques to adjust the transmissions for optimum signal strength.

SATELLITE INFORMATION

We have received a good number of enquiries as to the frequencies, and modes of transmissions radiated by the various satellites which pass near this country. From a number of various sources we have been able to compile the following list, of satellites in orbit and the frequencies used, at the time of going to press.

Ariel 1. (S.61) Orbit time 105 minutes. Continuous carrier on 136.408Mc/s.

Ariel 2. Orbit time 106 minutes Continuous telemetry on 136.558 Mc/s.

Tiros 4. Orbit time 105 minutes Continuous carriers on 136.23Mc/s and 136.92Mc/s.

Tiros 5. Orbit time 104 minutes Continuous carrier on 136.232Mc/s and 136.923Mc/s.

Tiros 8. Orbit time 104 minutes automatic picture transmissions on 136.95Mc/s with continuous carriers on 136.26Mc/s and 136.92Mc/s.

Echo 2. Orbit time 109 minutes. Continuous beacons modulated with telemetry signals on 136.02 Mc/s and 136.17Mc/s.

Transit 4A. Orbit time 109 minutes. Continuous carriers on 150Mc/s and 400Mc/s. Two other transmissions on 54Mc/s and 324 Mc/s have ceased.

Explorer 20. Orbit time 104 minutes. Frequencies of top side so under transmitter 1.5Mc/s, 2.0Mc/s, 2.85Mc/s, 3.72Mc/s, 5.47Mc/s, 7.22Mc/s. Telemetry channel commanded from the ground on 136.35Mc/s. Tracking beacon on 136.68Mc/s.

Explorer 22. Orbit time 105 minutes. Continuous carriers on 20.065Mc/s, 40.01Mc/s, 41.01Mc/s, 360.09Mc/s. Tracking beacon on 136.17Mc/s.

A.E.I. (N.Z.) LTD. RE-ORGANISATION

In order to streamline their operations in New Zealand, Associated Electrical Industries (N.Z.) Limited have effected certain re-organisation plans which involve certain changes of duties and transfers.

Mr F. K. Garry is to undertake special administrative duties for the company and will be remaining in Auckland.

Mr R. M. A. Smith goes to Auckland as Manager of Northern area covering the Northern half of the North Island.

Mr L. A. Fairey also goes to Auckland as Assistant Manager, Northern Territories area.

Mr A. G. Emms goes to Christchurch as Manager of the South Island District.

Mr J. N. Tod has been transferred to A.E.I. Wellington to become Manager of the Head Office Engineering Department.

A.E.I. Rotorua branch has been closed down and A.E.I. Auckland absorb the Rotorua area into their field of activities.

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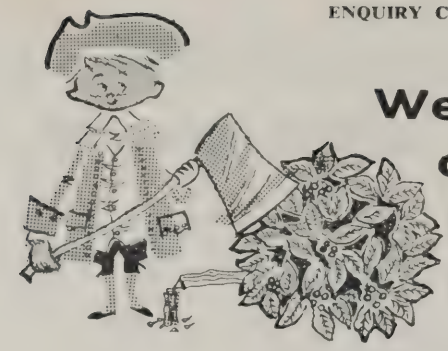

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AUCKLAND.

book reviews

This month we have three books on widely differing subjects for review. The first one selected is entitled "Electromagnetic Slow Wave Systems" by R. M. Bevensee, Assistant Professor of Electrical Engineering, University of California, Berkeley.

With the ever increasing use of microwaves for communications, measurement, heating, radar and countless other uses, the modern electronic engineer must read, understand the operation of all parts of the system. For this reason this book will prove of inestimable value. As is mentioned in the preface veteran workers as well as beginning students of electromagnetic theory are strongly urged to read the introduction for a review of basic concepts of slow wave structures and the authors definitions of the more common terms which are often carelessly used.

Chapter 1 reviews the periodicity properties of various slow wave structures and follows with the literature pertaining to the propagation characteristics of helical and loaded wave guide structures. Chapters 3 and 4 deal with properties of lightly coupled cavities with further extensions of the theme in chapter 5. Chapter 6 introduces a general analysis of helical slow wave structures and this treatment is continued in a systematic approach to resonant slot and loop coupled cavity chains in Chapter 7. Chapter 8 and 10 discuss both general and specific aspects of propagation in helex type travelling wave tubes. Special features in the remaining chapters are a thorough description of the coupling of electromagnetic fields through small apertures, and an extensive description of the waves in three frequency cavity chain parametric amplifiers and maser slow wave systems.

Our copy by courtesy of the Publishers.

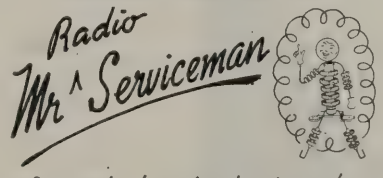
The second book we have for review this month is recommended for audiophiles and sound engineers. It is entitled simply "Loudspeakers" by G. A. Briggs, assisted by R. E. Cook, B.Sc., as technical editor. Published by Wharfedale Wireless Works Ltd., Yorkshire.

Originally published in 1948, this book has been reprinted through 4 editions, and now finally in a Fifth, completely revised and enlarged to 336 pages.

There are 31 chapters plus reference tables and index and thus it proves impossible to cover each and everyone within the framework of a review. Two chapters are utilised in the writer's reminiscences over 25 years experience in the loudspeaker field. Magnets old and new, cones, voice coils, frequency response distortion, resonance and vibration are all covered in simple and effective fashion. For the technically inclined, Impedance and Phase angle, Decibels and Phons, volume and watts, transients, crossover networks, negative feedback and output transformers; all are covered, some not completely, but most, sufficiently, to keep this book in the class of a reference text as well as being an entertaining and readable publication. For the audiophile there are chapters devoted to baffles, cabinets, and horn loading, the ear, room acoustics and stereo. For the architect even, the chapters on room acoustics, concert halls and sound reproduction in schools should make worthwhile reading.

There are a number of questions and answers which make instructive reading whilst the index, though not long is sufficient.

ENQUIRY CARD AD. 16



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Inductance Specialists LTD.

Our copy came from the agents for the publisher, Technical Books Ltd.

The third book this month is another of the many texts on Transistors being written and published. This volume is entitled "Properties and Applications of Transistors", by J. P. Vasseur—Head of the Laboratory at the Compagnie Generale de telegraphie Sans Fil, translated by D. E. Rodley and J. R. Garrood and published by Pergamon Press Ltd., Oxford. The authors of this book was one of the first French engineers to study the applications of transistors. He was entrusted with the organisation of a series of lectures in order to initiate his colleagues in the use of the transistor and this book takes advantage of the experience he acquired in the cause of his preparations and discussions.

Prior to the first chapter there is an introduction giving the meaning and notation of symbols. In chapter 1 the structure of semiconductors, n-p junctions and the junction transistor are introduced together with modern transistor technology and other types of transistors such as the tetrode, drift, p.n.p.n. and field effect device. Chapter 2 presents a general discussion of the linear 2-port presentation of a transistor followed in Chapter 3 by a survey of the characteristics of transistors. Chapter 4 discusses the transistor as a linear amplifier followed by 2 very interesting and useful chapters — namely Bias circuits and discussions on the maximum ratings of a transistor. These two chapters give complete and yet concise coverage of two very important aspects of transistor circuit design. The last chapter, No. 7, discusses Noise in Transistors, once again turning to the 2-port approach as a method of approach.

Each chapter is well illustrated, there are many helpful references, a useful list of tables which are spread throughout the text and quite a comprehensive index.

In all, this book should prove to be an illuminating and useful text to have on the shelf.

Our copy by courtesy of the Publishers.

Serviceman's Column

contd. from page 23

with a new tube the good lady insisted on paying something towards the cost of it. We finally settled on £5 as representing roughly one fifth the cost of the new tube, assuming the past two years use to be one fifth of a 10 year life expectation.

Of course I resolved to be more careful in future, one can't afford too many of those sort of accidents Still it was an experience and now its over and done with I'm not altogether sorry it happened. I think every TV serviceman should be allowed one picture tube breakage!

\+ + +

Elsewhere in this issue you will find a contribution on repairing communications type receivers which apart from being a learned treatise on the subject is also something of a commentary on the habits of the users of this type of receiver. But as T.C.K. is himself a member of the ham fraternity perhaps this gives him a certain amount of license in this direction!

Finally I must record my pleasure in seeing a request of long standing fulfilled at last. To explain — like many other servicemen I have been using a replacemen volume control of Italian manufacture for many years now but every time I had to file a flat on the shaft I used to think "Why can't we get these controls with the milled flat on the shaft?" Finally I decided to stop the wishful thinking and do something about it. The first step was to ring the Auckland distributor who admitted that he had never given the matter a thought and said that no one had ever raised the matter before. He agreed that the idea was a good one and promised to take the matter up with the N.Z. representatives. So after over a year of waiting I am able to report that the latest arrivals of this make of control now have flats on the shafts. No more filing!

JOURNALS WANTED !

Copies of the journals below are wanted to fill library shortages:

ELECTRONIC ENGINEERING

September 1959
December 1962
January 1963
March 1963
August 1963

WIRELESS WORLD

February 1962
May 1962
July 1962
October 1962
November 1962
December 1962

Also complete volumes, prior to 1964, of:

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ELECTRONICS WORLD

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Acoustics Engineer,
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ENQUIRY CARD AD. 17

one drop of Electrolube improves contact performance and saves you time and money on maintenance costs.

This unique electrical contact lubricant is the "spot-on" answer to contact wear and corrosion. On assembly it ensures perfect functioning and increases (up to 400%) the life of turret tuners, switches, potentiometers etc.

Electrolube can correct faults without dismantling — it improves conductivity and inhibits arcing. Also suitable for mechanical parts, such as spindles. In handy drop-at-a-time "snorkel" containers, "pen" applicators, and aerosol. Oils and greases for arcing and non-arcing contacts.

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SCIENCE CONGRESS

Continued from page 27

SWITCHING CHARACTERISTICS

J. B. Earnshaw, University of Auckland

As a result of the non-linear resistive and capacitive characteristics of tunnel diodes calculation of their switching waveforms is not straightforward. It was shown how the transient analysis of a simple linear R-C circuit can be extended to predict these switching waveforms and to determine their dependence upon triggering, bias, and load conditions.

Critical comparisons of various linear-piecewise approximations to the tunnel diode characteristics were made.

COUNTERS

Z. C. Tan, University of Auckland

The design philosophy of digital counters employing series connected tunnel diodes was presented together with some results from an experimental quinary counter capable of operating at 25 Mc/s.

PARALLEL ADDER

P. McA. Fenwick, University of Auckland

The basic logical operations in digital computers and their realisation using a new high speed logic circuit was discussed.

A major problem in the design of adders for parallel type computers is that of reducing the carry-digit propagation-delay and this was dealt with in detail.

STORAGE APPLICATIONS

J. B. Earnshaw, University of Auckland

After reviewing the various types of tunnel diode memory cells, the advantages of a new tunnel diode — transistor memory cell, and its application in a small but very high speed storage system, were described.

LISTENING POST

Continued from page 25

Monitoring observations should preferably be carried out between 1900 and 2300 GMT daily from May 25th to June 4th and SINPO observations of the chosen transmission or transmissions made at regular intervals during those periods. A calibrated signal strength meter is essential and receiver controls, antennae and other factors likely to affect the final results must be the same for each monitoring session. If possible, tape recordings can be made to illustrate the SINPO observations.

Mr Meisel points out that although several frequencies would provide good coverage, the lowest useful frequency for the transmission path under non-eclipse conditions should be used in order to obtain maximum eclipse reaction. He hopes that some shortwave stations, either commercial or amateur, will arrange test transmissions for observation purposes over the eclipse period, and it is quite likely that transmissions will originate from the islands in the Pacific on which various scientific parties are situated, although details of frequencies are not yet known.

Final results of observations, along with details of frequencies, type of receiver, receiver location, antennae and other relevant information can be sent to Mr Meisel at the above address from which further details can be obtained.

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NEW PRODUCTS

NEW POCKET TELEPHONE

This pocket-size transceiver, recently introduced by a British manufacturer and claimed to be one of the smallest units of its type, will aid communication between dispersed personnel.

For key workmen on building sites, the "Televex" can become a pocket telephone with no wires attached.

The transceivers are supplied with a detachable battery compartment and a larger battery compartment is available when exceptionally long operating periods are likely. Alternatively the battery unit can be replaced by a plug/adapter connecting to a separate power supply.

The unit incorporates four crystal controlled channels and is complete with an internal speaker/microphone.

Under very noisy conditions the sets can be used with noise-excluding headsets.

ENQUIRY CARD 105

* * *

NEW REFLEX KLYSTRON AVAILABLE FROM WESTINGHOUSE

A reflex klystron tube designed for use in low-power transmitter applications is available from the Westinghouse Electronic Tube Division. The WL-135 is an integral cavity, fixed frequency reflex klystron with a low-power heater requiring only three watts for efficient operation. It is especially suited for police radar equipment.

The tube operates at a frequency of 10.525 gigacycles. At this frequency, it delivers an output power of 100 milliwatts with a beam voltage of 400 volts on the resonator.

The new klystron employs conduction cooling through the use of a low thermal-impedance-waveguide output section. The waveguide can mate with either UG39/U or UG40/U type fianges. Flying leads complete this rugged tube.

The weight of the extremely compact klystron is only six ounces.

ENQUIRY CARD 103

* * *

TORQUE MEASUREMENT ACCURACY BETTER THAN 25 P.C.

Torque measurement with a consistent accuracy of 25 per cent or better is possible with the Type 1502 digital torquemeter now being produced by Dawe Instruments Ltd., of Acton, London, W.3. The general-purpose instrument has been developed from a design by the Ford Engineering Research Centre for development of automotive transmissions. It consists of two units, the torsiometer and the digital torquemeter itself, connected to each other by up to 50 feet of cable. The torsiometer unit is essentially a shaft of accurately calibrated stiffness located in two precision bearings mounted in a cast housing. Torque increase is measured through the time lag between two trains of pulses by means of radially slotted steel discs, light sources and photocells. The torquemeter, a sophisticated electronic instrument, provides two digital

Radio, Electronics and Communications

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FEBRUARY, 1965

readouts, one for speed and one for torque. It operates over a speed range of from 100 to 5000 rev/min with an accuracy typically better than 25 per cent for a 3° twist. Standard torsiometer shafts are for maximum limits of torque of 1, 50, 100, 200, 500, 1000 and 2000 lb-ft. The standard torquemeter, designed for 19-inch rack mounting, measures 19 inches x 10 inches x 12¼ inches and weighs 34 lb. The torciometer measures 13¾ inches x 9½ inches x 9½ inches and weighs 60 lb.

ENQUIRY CARD 98

* * *

PRECISION TUBE

One of the leading British electronic companies, Ferranti Ltd., has developed a remarkable new type of high-precision cathode ray tube (c.r.t.) suitable for transistorised military and industrial equipments.

The cathode ray tube and glowing screen used for domestic television receivers will be familiar to many people: the industrial and military types are similar, though usually smaller and more precise.

These high-performance tubes, or high-resolution tubes as they are technically known, normally employ a large wire focussing coil mounted externally round the "gun" of the tube; this coil produces a magnetic field which focusses an electron beam on to the phosphor screen. The method has the disadvantage of requiring complicated and large power supplies from the associated equipment, which is then inevitably bulky and heavy.

To overcome the disadvantage, Ferranti scientists have completely redeveloped a previously unsuccessful lens system known as the zero-voltage electrostatic lens. This system employs a relatively small metal lens mounted within the tube which produces the required focussing forces when the metal is electrically charged.

ENQUIRY CARD 109

* * *

A highlight of the Plessey Group Stand at the British Exhibition in Sydney in December 1964 was a display of aircraft equipment.

Of particular significance was the Plessey-UK contribution to vertical take-off and landing techniques. On display, for example, was the nozzle actuation system for the Hawker P 1127 VTOL strike aircraft; and the fuel system for the Rolls Royce RB 162 pure-lift gas turbine. There was also a display of other aircraft equipment, including fuel booster pumps, control synchros and servo units.

The complete Plessey Group exhibit at Sydney ranged over the entire field of modern telecommunications, electronics and industrial hydraulics. Among the items which attracted Australian industry and commerce, including Government departments, were an electronic mail sorting system, a solar-powered alarm system, the newest type of 'crossbar' automatic telephone exchange and a range of record players including a new battery-powered version of the Garrard Autoslim.

ENQUIRY CARD 110

* * *

SOFT X-RAY MONITOR

A lightweight portable radiation monitor, this Avo instrument will prove of great interest to the television and radio industry, also to hospitals and colleges for the measurement of soft X-rays generated by transmitting valves, cathode ray tubes and high speed discharge tubes, and those resulting from the scatter of X-rays generated by industrial X-Radiography.

Incorporating a Geiger Muller tube having a flat response to soft X-rays over the 7.5 KeV to 25 KeV region, the instrument is driven by 12V Mallory batteries. 3 ranges of measurement are available — 0.2mr/h, 0.20mr/h, and 0.200mr/h.

ENQUIRY CARD 111

* * *

'READ VITAL DATA AT A GLANCE'

Latest Addition to Sanborn's Comprehensive Medical Instrumentation Line

A new lost-cost numerical readout is now available which will display the values of any four slowly varying vital states — conveying information at a single glance, eliminating parallax errors and reading delays. Valuable in the OR, recovery room, intensive care area or research laboratory, for displaying any four of these phenomena . . .

* Systolic pressure, 0-300 mm/Hg
* Diastolic pressure, 0-300 mm/Hg
* Venous pressure, 0-30.0 mm/Hg
* Mean pressure, 0-300 mm/Hg
* Heart rate, 0-300 beats/minute
* Pulse rate, 0-300 beats/minute
* Respiration rate, 0-75 breaths/minute
* Temperature, degrees Centigrade, Low range, 10.0-40.0; High range, 30.0-45.0
* Temperature, degrees Fahrenheit, 90.0 - 105.0.

Change the readout for new variables by changing modules, or in many cases, same module may be used for the new readout desired. Each module displays three digits and a lighted decimal point. Decimal point can be manually set and will flash in sychronism with any periodic event monitored, showing regularity of event while numerals show average rate. Sampling interval is adjustable from 10 seconds to 1.5 seconds. The 5601A Numerical Display requires signals from Sanborn preamplifiers as used in Series "350" oscillographic systems, "760" monitoring systems, "780" monitoring units, "3900" tape recorders, or from other instruments with similar outputs.

ENQUIRY CARD 112

* * *

SWEEPER GENERATORS

Hewlett-Packard Microwave Engineers Design for Microwave Engineers

The noticeable volume in Sweeper Oscillator applications has led to a greater range than was previously available. Twelve standard increments (stop frequency, minus start frequency) are now available. These are in the following: 1.0, 1.6, 2.0, 2.5, 3.2, 4.0, 4.4, 4.6, 5.4, 5.6, 5.8, 13.5 gc., and are available in twenty-three models. Power output (maximum-levelled across band) ranges from at least 60 mw to at least 5 mw with an accuracy (centre frequency) of plus or minus 10Mc/s to plus or minus 40Mc/s, or plus or minus 1%.

These sweepers give start-stop sweep, up or down, between any points in the range; Marker Sweep for expanding any portion of the major sweep; and Delta F. Sweep; symmetrical sweep round the centre point; manual sweep for detailed study of a localised area; automatic recurrent sweeps; sweep synchronised with line frequency; sweep-concurrent voltages for scope and X-Y recorder.

All this from one instrument, plus new ease of operation. Outstanding visibility, push button sweep and modulation section, velling options and new accuracy and value.

ENQUIRY CARD 113

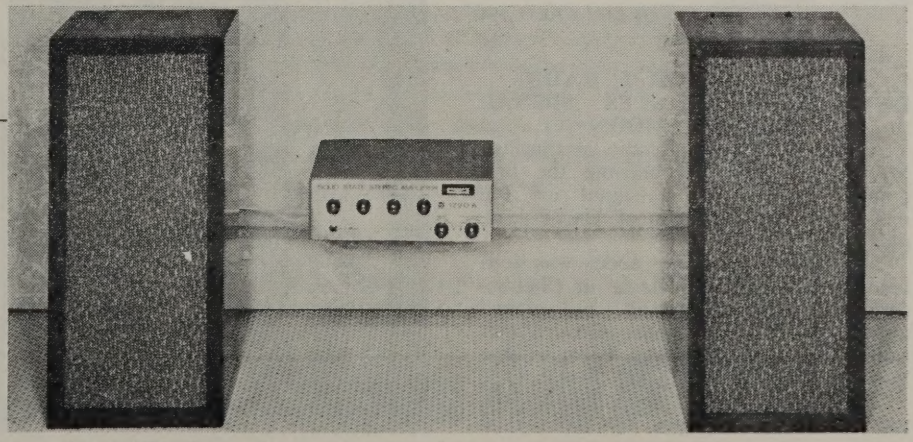
* * *

P. H. Rothschild & Co. Ltd. announce the availability of a wide range of new MOODY KIT lines of tiny tools, some in stock, some on order. Among the tool sets in stock are Socket Wrench Sets, Pin Vices, Pocket Magnet with Clip, Pocket Scriber with Clip, Jeweller's Screwdrivers, Carbide Pocket Scriber. In addition an almost limitless range of other sets can be obtained for a wide variety of electronic uses.

ENQUIRY CARD 115

Redfern "Eight" "acoustic designed" loudspeaker Enclosures are available to users of the 1720A. These speakers are true heavy magnet high fidelity double cone units, of compact dimensions. The cabinets are built from ¾" thick solid chipboard, acoustically damped and semi-lined with 1" thick felt. Outside dimensions of cabinet 24" x 11" x 9½". The voice coil impedances of these speakers are specially wound to suit the 1720A. (Mahogany polished finish). Manufactured by REDFERN RADIO.

ENQUIRY CARD 114



NEW PRODUCTS

NEW EDITION OF D.S.I.R. HANDBOOK

The Department of Scientific and Industrial Research (D.S.I.R.) has just issued a revised edition of its Handbook.

This attractively printed and illustrated publication summarises briefly the history of the Department and indicates the functions of its 23 different branches and the eight industrial research organisations with which it is closely associated.

Established in 1926 to co-ordinate the activity of the five existing government scientific services, and to undertake scientific and industrial research, the department has extended its work to cover most branches of science.

Agricultural research was first undertaken by the department in 1929 when it operated a Plant Research Station with the Department of Agriculture. This station was taken over by D.S.I.R. in 1936 and formed the nucleus of the agricultural branches of which there are now twelve undertaking research on various aspects of agriculture and horticulture.

Of the non-agricultural branches, the oldest are the Geological Survey and the Chemistry Division, both of which celebrate their centenary next year. Of much more recent vintage are the Institute of Nuclear Sciences, the Oceanographic Institute and the Antarctic Division which have all been set up in the last ten years.

A number of these branches are concerned with assistance to manufacturing industry. The Auckland Industrial Development Division was set up specially for this purpose, while the Physics and Engineering Laboratory has recently extended further its industrial liaison work. The Chemistry Division undertakes research in fields of economic importance to New Zealand so that knowledge for future technological development will be available when needed.

In addition the eight industrial research organisations are playing an important role in helping their particular industries to benefit from the application of scientific information, principles and research.

This publication is obtainable free from the Department of Scientific and Industrial Research, P.O. Box 8018, Wellington, or we will obtain a copy through this office.

ENQUIRY CARD 104

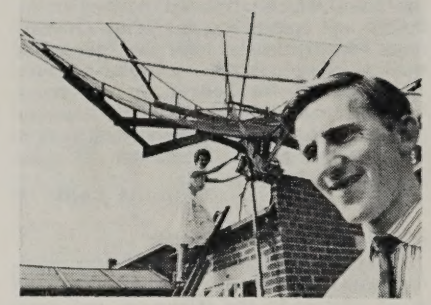
* * *

BRITISH AMATEUR RADIO ENTHUSIAST BOUNCES SIGNAL OFF THE MOON

A British amateur radio enthusiast, Mr. Peter Blair, has become the first amateur to bounce a signal off the moon . . . with the help of his 28-year-old wife.

The signal, in morse code, was sent from a radio in their home in Chelmsford in southern England, and picked up by the United States Government radio telescope in Porto Rico in the West Indies.

To do this, Mrs. Blair sat on the roof of the garage and kept the aerial



pointed at the moon by hand, while the signal was transmitted.

Picture shows Mr. Blair and his wife-operated aerial dish. The radio telescope on which the signal was received cost over £3 million . . . the Blair aerial cost £5.

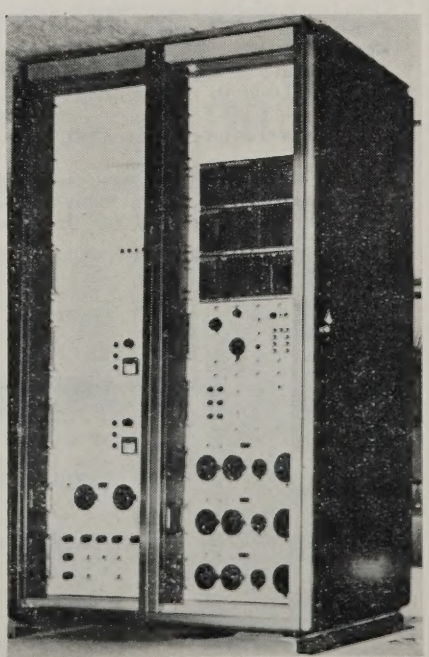
CARD 106

* * *

RADAR AND RADAR SIMULATOR FOR NEW NORWEGIAN TRAINING SHIP

Two British companies, Associated Electrical Industries Ltd., of Leicester, and Solartron Ltd., of Farnborough, Hants, have collaborated in supplying electronic equipment for the motor ship Trondelag built by the Norwegian Ministry of Shipping and Trade. They have provided marine radar displays and a marine radar simulator to make this the first vessel in the world to have such facilities for training Merchant Navy officers.

The AEI Electronics Group has provided one of the new Escort 653 13-inch relative motion radars on the bridge and an Escort 601 true course radar in the blind navigation training room. In addition, six more Escort displays have been supplied to work in conjunction



with the radar simulator developed and supplied by Solartron. One of these is an Escort 601 display and the other five are Escort 653 displays. The simulator itself not only produces the effects of other vessels, and a coastline, but can reproduce the handling characteristics of any radar-carrying ship from a tanker to a fishing boat. The combined navigational equipment will be used to train Norwegian Merchant Navy officers in all aspects of navigation and ship handling for their second mate, first mate and master's certificates.

ENQUIRY CARD 97

* * *

TRANSISTORIZED, LIGHT-WEIGHT DOUBLE OR SINGLE PULSE GENERATOR

A new, light-weight solid state pulse generator utilizing silicon transistors and providing rugged, reliable service has been introduced by Fairchild Scientific Instruments. With a minimum of semiconductors, the instrument achieves maximum versatility.

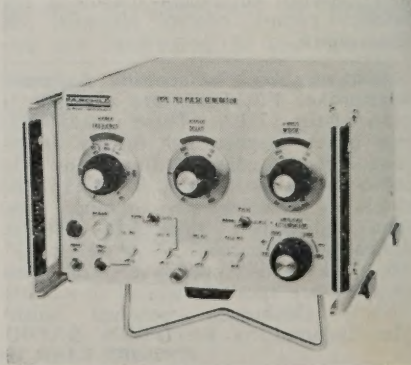
Main features include 10 MC pulses, gated pulses throughout the frequency range, constant amplitude with minimum droop, and amplitude of 10 volts into 50 ohms. A constant amplitude either single or double pulse is available independent of duty cycle.

Technical specifications include the following:

- Amplitude: 10V into 50 ohms—17 volts into 1000 ohms.
- Polarity. Positive or negative output.
- Rise Time: 10 nsec or less (into 50 ohms).
- Fall Time: 10 nsec or less (into 50 ohms).
- Droop: Negligible on all ranges.
- Under and overshoot: 5% or less at maximum amplitude.
- Repetition Rate: 50 CPS to 5 MC, double pulse to 10 MC.
- Trigger Delay: The 792 may be externally triggered and single shot mode is provided.

Price of the 792 double or single pulse generator is $525 complete with power cord, manual, termination, and cables. Rack mounting hardware for 5¼ inch panel height and 19 inch size is optionally available.

ENQUIRY CARD 102



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ENQUIRY CARD AD. 18

what do you see when you look into this tube...?

A WORLDWIDE ORGANISATION

Look hard - really hard, for behind every Miniwatt trade-marked tube stands a worldwide organisation of repute and renown. An efficient organisation with top-ranking scientists in metallurgy, chemistry, electronics, physics..., vast laboratories..., thousands and thousands of specially trained workers. experience of many years of manufacturing... and these are but a few aspects of what goes into producing tubes of top-quality..... Miniwatt tubes. What does this mean to you?

YOUR GAIN!

And not only your gain - but your customers' as well! For your customers rely upon you to do a good job when their sets need repair. And satisfied customers will come back and buy from you again and again. Miniwatt makes for satisfied customers. They know they can rely on you, you know you can rely on Miniwatt... always to have the right tube in stock... always a guaranteed top quality... and to render you the service only a leading manufacturer can - both now and in the future!

A WORLDWIDE ORGANISATION IS BACKING UP YOUR BUSINESS

PHILIPS

PHILIPS MINIWATT

Advance power supplies

Power Supply Unit PP1

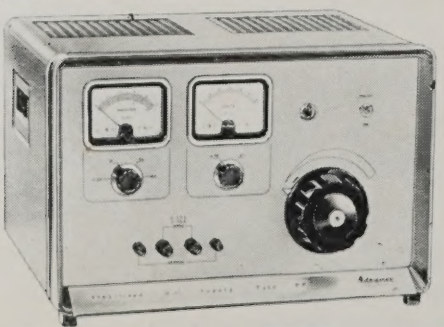
Input voltage 94 to 138V, 187 to 276V, 50c/s only. *Outputs*

Supply No.	*1*	*2*	*3*	*4*	*5 and 6*
Voltage	0 to 600V DC	+100 to +800V DC	−200V DC fixed	0 to −200V DC	6·3V AC (r.m.s.)
Maximum current	300mA total	300mA total	50mA	5mA	4A each
Maximum source impedance (ohms)	0·1 (DC) 0·5 (at 50kc/s)		0·1 (DC) 0·3 (at 30kc/s)	13K	
Maximum ripple voltage (r.m.s.)	3mV	3V	1mV	1mV	
Stabilisation factor within permissible mains variation	1000 : 1	4 : 1 essentially unstabilised	1000 : 1	1000 : 1	15 : 1
Short circuit protection	e.m. cut-out	e.m. cut-out	100MA fuse F.3		Stands brief short circuits

Special features *Variable source impedance* Source impedance of supply No. 1 variable from 0·1 to 40Ω. *Artificial ripple injection* (a) *Internal* 50c/s up to 6V. (b) *External* Up to 50kc/s from external generator working into 5Ω load. *Metering* Two meters are fitted. *Dimensions* 19¾in (50cm) wide × 13 in(33cm) high × 15in (38cm) deep. *Weight* 92 lb (42kg).

Power Supply Units PP2 PP4

Input voltage 100 to 125V, 200 to 250V, 50c/s only. *Output voltage* PP2 0 to 50V d.c., PP4 0 to 80V d.c. both continuously variable. *Current* PP2 0 to 10A, PP4 0 to 6A. *Impedance* Less than 0·25Ω up to 100kc/s (4-terminal output provided). *Resistance* Less than 0·003Ω. *Stabilisation* Input voltage variations of ±15% are permitted, stabilisation factor 5000: 1. *Ripple* Less than 2mV pk.pk. *Metering* Two meters are fitted.



PP2

PP2 Ammeter switched in four ranges as follows 0 to 0·3A, 0 to 1A, 0 to 3A, 0 to 10A. Voltmeter switched in two ranges as follows 0 to 6V, 0 to 60V.

PP4 Ammeter switched in four ranges 0 to 0·2A, 0 to 0·6A, 0 to 2A, 0 to 6A. Voltmeter switched in two ranges 0 to 10V, 0 to 100V. *Overload protection* Resettable cut-out operates when load current exceeds 125% of ammeter F.S.D.; cut-out occurs within 0·2ms of the overload. A thermal cut-out provides protection against excessive internal temperatures at maximum load. *Dimensions* 20¼in (51·4cm) wide × 13¼in (33·6cm) high × 16¼in (41·3cm) deep. *Weight* 140lb (63kg).

Power Supply Unit PP3

Input voltage 90 to 130V, 200 to 240V, 40 to 60c/s. *Output voltage* 0 to 30V d.c. in three ranges, 0 to 10V, 10 to 20V, 20 to 30V. *Current* 0 to 1A. *Impedance* (d.c.) Less than 0·01Ω. *Impedance* (a.c.) Less than 0·2Ω up to 100kc/s. *Ripple* Less than 0·5mV pk.pk. *Stabilisation* 7% supply variation varies output by approximately 10mV. *Metering* An ammeter and a voltmeter, switchable to either output. The ammeter has two ranges 0 to 0·1A F.S.D. and 0 to 1A F.S.D. *Overload protection* Resettable electronic cut-out. *Operating temperature* Up to 35°C (ambient). *Dimensions* 18in (46cm) wide × 13¼in (33·5cm) high × 11½in (29cm) deep. *Weight* 38lb (17·25kg).

A Rack mounted version is also availabie– PP3R.

Power Supply Unit PP6

Input voltage 110, 120, 220, 240V ±15%, 50c/s only, 160W each section. *Output voltage* 0 to 30V in six overlapping ranges. *Current* 0 to 3A at any output voltage. *Impedance* (d.c.) Less than 0·02Ω; (a.c.) less than 0·2Ω up to 100kc/s. *Ripple* Less than 1mV pk.pk. *Stabilisation* 3000: 1 permits supply variations of ±15% above and below nominal value. *Metering* Two meters are fitted. An ammeter 0 to 0·1A, 0 to 0·3A, 0 to 1A and 0 to 3A F.S.D., and a voltmeter 0 to 30V. *Overload protection* Resettable electronic cut-outs adjusted to operate at 125% of F.S.D. on any current range. *Operating temperature* Up to 35°C (ambient) at full load.

Dimensions 20in (50·7cm) wide × 13in (33cm) high × 15in (38cm) deep. *Weight* 70lb (31·8kg).

ADVANCE ELECTRONICS LIMITED ENGLAND

Sole New Zealand Representatives

TURNBULL & JONES LTD.

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FROM THE COMPREHENSIVE RANGE OF Advance INSTRUMENTS AND EQUIPMENT